REPUBLIC OF TÜRKİYE

ALTINBAŞ UNIVERSITY

Institute of Graduate Studies

Civil Enginnering

THE CAUSES OF CONSTRUCTION PROJECT DELAY IN IRAQ (NAJAF)

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Master's Thesis

Supervisor

Assoc. Prof. Dr. Sepanta NAİMİ

İstanbul, 2023

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2023

The thesis titled THE CAUSES OF CONSTRUCTION PROJECT DELAY IN IRAQ (NAJAF) prepared by SAEED THAMER SAEED ALNASERI and submitted on 26/12/2023 has been **accepted unanimously** for the degree of Master of Science in Civil Engineering.

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I hereby declare that this thesis meets all format and submission requirements of a Master's thesis.

I hereby declare that all information data presented in this graduation project has been obtained in full accordance with academic rules and ethical conduct. I also declare all unoriginal materials and conclusions have been cited in the text and all references mentioned in the Reference List have been cited in the text, and vice versa as required by the abovementioned rules and conduct.

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Signature

DEDICATION

I'd like to thank my parents, who have supported me and helped me the most throughout my life. Without their consistent support, I never would have been able to complete the assignment. It would be unforgivable on my part if I didn't let my closest friends and family members know how much their support means to me. They were always there to lift my spirits and assure me of my limitless potential, whether I was happy or depressed. Finally, I'd like to thank everyone who made me feel welcome and included during my stay.

PREFACE

Before anything else, I want to thank God for giving me the tenacity and perseverance to finish what I started.

Thereafter, I would like to extend my sincere gratitude to my supervisor for his unwavering direction and support throughout the project as well as for his persistence, inspiration, and depth of knowledge. As I've done research for my thesis under his guidance, I've been able to grow more independent. I wish him success in anything he undertakes. I also like to thank the other thesis committee members for their constructive advice and constructive criticism. In addition, I'd like to thank everyone who has encouraged or believed in me while I've worked to achieve my goal of getting a college degree.

Finally, I would like to express my gratitude to my fellow master's students as well as to my coworkers for their moral and emotional support throughout the writing and research of my thesis.

ABSTRACT

THE CAUSES OF CONSTRUCTION PROJECT DELAY IN IRAQ (NAJAF)

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Date: December / 2023

Pages: 119

The construction sector holds significant importance within the setting of Iraq. It is well acknowledged that a significant proportion of construction projects in this country frequently have delays in meeting predetermined timelines and surpass intended budgets, often occurring simultaneously. The major aims of this Thesis are to investigate the impacts of building items deficiencies and to identify the primary factors contributing to these shortages in Iraq.

To accomplish the aforementioned objectives, a comprehensive examination of existing literature and a survey methodology are employed. The survey requires key stakeholders involved in the advancement of infrastructure, housing, transportation, and healthcare initiatives to complete a questionnaire. The present survey possesses the capacity to be dissected into its constituent elements. The main aim of this study is to assess the influence of resource constraints on project delays by comparing them with alternative factors. The inclusion of the 20 criteria in the questionnaire has been derived after a meticulous examination of the pertinent scholarly sources. This study involved the participation of a sample of fifty individuals who are professionals in the construction sector. The sample included various roles such as managers, consultants, subcontractors, project engineers, and academic specialists. The subsequent section of the study aims to identify and assess the primary causes that contribute to shortages in materials. The aforementioned concerns can be categorized into four distinct groups, namely technological, experiential, managerial, and

governmental. The analysis has two goals: first, to determine how important material shortages contrast with other explanations for delays, and second, to determine what factors are most responsible for shortages of materials.

This thesis presents research that sheds insight on the causes of Iraq's looming shortage of construction materials. The closure of nearby material manufacturing facilities as a result of governmental rules, the lack of an adequate material managerial structure in building endeavours, And the lack of skilled owners or managers to oversee the current firms producing building materials are all contributing factors.

Keywords: Project Delay, AHP, Project Manager, IMPI, Construction Delays.

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ABBREVIATIONS

AHP	:	Analytic Hierarchy Process
CPM	:	Critical Path Method
CPA	:	Contemporaneous Period Analysis
IMPI	:	Importance Index Method

1. INTRODUCTION

1.1 HISTORICAL BACKGROUND

The construction sector plays a pivotal role in the economic progress of a nation, thereby carrying substantial significance. The industry has a high degree of dynamism and holds significant importance in driving both the economic and social advancement of a nation [1]. Construction projects have a significant role in enhancing the quality of life in the neighbouring community through the establishment of essential infrastructure, including transportation networks, healthcare facilities, educational institutions, and hospitality firms. Hence, ensuring the effective completion of building projects within pre-established timeframes, financial constraints, and quality standards is of utmost importance.

According to the publicly accessible information, Iraq is recognized as the third most prominent oil exporter in the region, positioned after Iran and Saudi Arabia [2]. Since 2003, there has been a significant increase in development initiatives in both urban and rural regions of Iraq, primarily attributable to the nation's dependence on the oil market. The construction sector in Iraq, encompassing both public and private entities, ranks among the most significant in the Middle Eastern region[3]. The public sector encompasses governmental agencies and departments responsible for the administration and oversight of national projects and the development of infrastructure. Private construction projects refer to those that are financed or possessed by an individual, a family enterprise, or a sizable firm [4].

According to estimates, the building sector ranks as the second-largest contributor to Iraq's Gross Domestic Product (GDP), The oil industry is the only sector that has exceeded it. According to data sourced from the Iraqi Ministry of Planning, it was noted that the construction industry accounted for around (30-40) % of the non-oil generating industries during each national development strategy implemented between 2004 and 2022. Gradually and steadily, the government is dedicating substantial financial resources to diverse development endeavours throughout the nation, several of which will have an impact on the most populous urban centres. One of the numerous challenges encountered by the Iraqi construction industry pertains to project delays.

In 2021, According to a survey published by the Minister “Ministry of Construction, Housing, Municipalities and Public Works”, it was establish that most government building projects in Iraq, specifically over 70%, were seeing significant delays. The delays were attributed to various variables specific to construction projects [5]. Moreover, the problem of project deadline delays has been recognized by [6] as a significant factor contributing to the challenges faced by the construction industry in Iraq. To ensure the punctual culmination of building endeavours in Iraq, it is imperative to effectively address and minimize the factors that contribute to project delays. The primary goal of the research is to look into the effects of material constraints on the progress of building construction in Iraq. The study also aims to identify and examine the factors that lead to the emergence of resource shortages in this specific setting.

1.2 THE ECONOMIC BACKGROUND OF IRAQ

In addition to its oil and gas deposits, Iraq's economy is supported by several sectors, such as the business department, the hotel industry, the tax on real estate base, the building and transport industries, and the financial services, shipping, and trading sectors. The various revenue streams have suffered major declines, which has had negative repercussions for the economy of Iraq as well as the ongoing combat. Furthermore, a significant reduction in specific foreign investment in the fuel sector and building sectors, which have traditionally been essential contributors to the Iraqi economy, may be related to the aftermath of the wars. These industries have traditionally been crucial contributors to the Iraqi economy. Significantly unfavourable effects were observed in the real estate industry as well as in tourist locations. The Iraqi economy is currently facing obstacles in its recovery due to the heavy dependence on the oil industry, which plays a large part in the economic framework of the country. These challenges are being brought about because of the recent conflict in Iraq. As a result of watching the effects that violence has had on the oil business, which has historically been responsible for a large amount of a country's export revenues [7].

1.3 IRAQI SOCIAL HISTORY

Iraq's population is characterized by a diverse array of languages and cultures. According to the estimates made in 2018, the total population of Iraq was approximately 30 million individuals. Approximately 77% of the population in the region is comprised of individuals

of Arab descent, while Kurds constitute an additional 19%. The remaining portion of the population is composed of various other communities, including Turkmens, Assyrians, and Armenians. Iraqi society can be categorized into three primary socioeconomic strata. The upper class comprises influential families, while the middle class encompasses government employees, affluent entrepreneurs, and military personnel. Finally, the class of people who are shorter includes farmers and workers. Approximately 3% of the population in Iraq identifies as Christian, while the majority, including around 95%, adheres to the Islamic faith. The remaining 2% of Iraqis follow a combination of other religious beliefs.

Iraq is home to several significant religious tourism attractions that hold great importance for Muslims globally. Among these are the Al 'Abbas Mosques and Al 'Askari located in Samarra, as well as the Gilani Mosque situated in Baghdad. The Christian, Jewish, and Yezidi populations, alongside other religious groups, hold the northernmost and southernmost regions of the Iraqi port in great esteem. Archaeologists have recently unearthed a Christian church, believed to have originated in the 5th century, located on the periphery of a city inside the province of Ninawa. Kerbela and Najaf are widely recognized as prominent sites for religious tourism, contributing significantly to the economic growth of Iraq. Religious landmarks has an inherent allure that draws people with diverse religious affiliations. Babel's Zul-Alkufl, for example, holds historical and cultural value for both Jewish and Muslim communities as an ancient urban centre. The grave of the prophet Younes (Jonas) in Mosul attracts followers of Christianity, Islam, and Judaism who visit it as a means of demonstrating homage. Iraq has been identified as the birthplace of numerous minority religions that have spread throughout various regions worldwide.

1.4 OVERVIEW OF THE ISSUE

The outcome of a construction project may be influenced by various circumstances, certain of which may lie beyond the purview of the builder. Sources of variation encompass a range of factors that contribute to fluctuations within the construction industry. These factors include the activities undertaken by different construction entities involved in pivotal projects, the availability, and accessibility of diverse construction materials, The factors that can influence a project include the existing environmental circumstances, the participation of other entities, contractual arrangements, design flaws, unexpected site conditions, changes in project scale, and other alterations made to the construction work. Issues are anticipated

in the construction sector globally due to the influence exerted by several factors on the ultimate result of any given architectural endeavour. The primary issue commonly encountered pertains to setbacks arising from factors such as inadequate inventory, delayed delivery, poor managerial practices, and a multitude of other circumstances, which will be expounded upon within the context of this thesis.

The construction sector in Iraq has garnered a negative perception owing to the widespread occurrence of delays in construction projects. The adverse impact of building delays has served as a source of inspiration for numerous scholars [8], prompting them to delve into the issue of construction delay. Previous studies have identified various factors contributing to building delays, many of which have had substantial implications for the construction industry in Iraq. A notable investigation employing statistical analysis was conducted to ascertain the elements contributing to delays in public projects [9]. However, the study did not examine the interrelationships between these factors and the resultant delays.

Given the fast expansion of construction projects in Iraq across several sectors, it is imperative to identify the underlying factors that may contribute to potential setbacks. This study examines the factors contributing to a scarcity of materials within the construction sector and evaluates their level of importance. Hence, the objective of this study is to quantitatively assess the comparative significance of different factors contributing to construction project delays and ascertain the potential impact of material shortages. The purpose of the study was to evaluate and determine the fundamental elements that contribute to shortages of materials in construction projects.

To mitigate the potential delays within Iraq's construction sector, it has become imperative to ascertain the fundamental factors contributing to the imbalance. Enhanced inventory and ordering management practices can effectively mitigate potential material shortages, hence facilitating adherence to project timelines and ensuring timely project completion.

1.5 AIM OF PROJECT

The goal of the present research was to determine how much Iraqi building delays had been impacted by material shortages. The goals were established to accomplish this goal.

a. The occurrence of material shortages in Iraq significantly contributes to the occurrence of delays in construction projects. It is important to conduct a comprehensive assessment to determine the extent of their impact.

b. This paper aims to conduct an analysis of the key factors contributing to material scarcity.

c. When evaluating material shortages, it is crucial to consider four key factors: technical aspects, knowledge, management practices, and government regulations.

1.6 GOALS AND LIMITATIONS OF THE STUDY

This research was undertaken as a component of his thesis. The scope of this research is confined to the building sector within the geographical boundaries of Iraq. All participants who completed the survey for this study were professionals within the Iraqi construction business. The purpose of the survey was to get their thoughts on several issues, including the delay factor. The individuals in question possessed either current involvement in the building sector of Iraq or possessed significant prior experience in the region. Additionally, a significant number of individuals were engaged in academic research and development within the building industry. The present quantitative study incorporated data derived from current studies, research undertaken by construction companies, government publications, and insights provided by construction specialists, encompassing contractors, consultants, and management of projects partners engaged in the realms of management, administration, and operations. Most participants consisted of individuals who held positions as project managers, project engineers, or academic specialists, with prior experience in at least one of these capacities. The skills and insights of the participants included in the sample were obtained through the administration of a questionnaire. The determination of the evolution and significance of material shortages, as well as the factors and difficulties associated with them, was conducted through the utilization of the Analytic Hierarchy Process (AHP) software [10], [11] and the Important Index (IMPI) technique [12].

1.7 THESIS STRUCTURE

The following is a summary of the five chapters that comprise this study:

Chapter 1: Provides an introduction and explains why this investigation was conducted. The document contains introductory information, a statement of the problem, a list of aims and goals, and a work scale delineation.

Chapter 2: This paper offers a complete analysis of the construction sector in Iraq, specifically focusing on doing thorough assessments of prior research studies related to delay issues. These analyses encompass a comprehensive examination of both the global context and the specific dynamics of the building industry in Iraq. The purpose of the data collection was to gain a comprehensive understanding of the difficulties posed by material shortages and their subsequent effects on the timeliness of construction projects.

Chapter 3: Explains the methodology employed in undertaking the research. In addition, the paper provides detailed information regarding the methodologies employed for data acquisition and the analytical approaches used for data interpretation.

Chapter 4: Examines the AHP method's development processes. Additionally, this study investigates the research conducted to provide an analytical analysis between the various elements that contribute to lack of supplies and other delays. This report also outlines the potential causes of a resource shortage.

Chapter 5: Provides a comprehensive summary of the main findings of this research. The work also discusses the study's basic drawbacks and makes recommendations for further investigation.

2. LITERATURE REVIEW

2.1 INTRODUCTION

The current section offers a full study of the corpus of studies on construction delays, as well as a comprehensive look at the Iraqi construction industry. The analysis encompasses a wide range of topics, including the causes and effects of delays, as well as the contributing factors involved. This section primarily focuses on the impact of insufficient materials on the project's progress, while the referenced sources also discuss additional factors contributing to construction delays globally and in Iraq.

2.2 THE CONSTRUCTION SECTOR IN IRAQ

Iraq is frequently acknowledged as a prominent regional power. Turkey and Iran are in Western Asia, serving as the northern and eastern boundaries, respectively. Kuwait and Saudi Arabia from the southeastern boundary, while Jordan and Syria constitute the southern and western borders. Baghdad, Figure 2.1, the foremost urban centre and administrative hub, encompasses a vast expanse measuring 168,754 square meters and sustains a substantial populace of over 39,485,000 individuals. Baghdad and Mosul are recognized as prominent urban centres within Iraq, with significant population sizes. Additionally, Basra and Kirkuk hold strategic importance as thriving economic centres. Najaf and Karbala, on the other hand, serve as alluring destinations for individuals seeking to immerse themselves in Islamic culture. Lastly, Erbil and Duhok have garnered popularity among Western tourists.

Iraq attracts people from all parts of the globe due to its investments, tourism industry, trade activities, and other factors. Many hotels in Iraq experience a continuous influx of customers.

Figure 2.1: City of Baghdad.

The demand for cement and steel bars used for strengthening structures is expected to significantly increase in the upcoming years due to ongoing rehabilitation operations in Iraq (Iraqbuild.org). Table 2.1 provides a comprehensive breakdown of the projected financial outlays for construction initiatives in Iraq spanning the period from 2020 to 2025.

Table 2.1: Strategy for Rebuilding Iraq from 2020 to 2025.

Types of Projects	Projects Budget ($)
Construction of power plants	600 Million
Housing and residential developments	6 Billion
Projects for Health	200 Million
Projects to build infrastructure	100 Billion

According to the Iraqi Ministry of Planning, it is projected that an amount exceeding $107 billion will be allocated towards the reconstruction efforts in Iraq. This substantial financial commitment underscores the imperative need for a consistent and reliable provision of construction materials. The building industry is expected to experience significant material shortages due to the inability of local suppliers to satisfy even 10% of the demand. Figure 2.2 presents a visual depiction of Iraq's construction initiative over the period from 2020 to 2025.

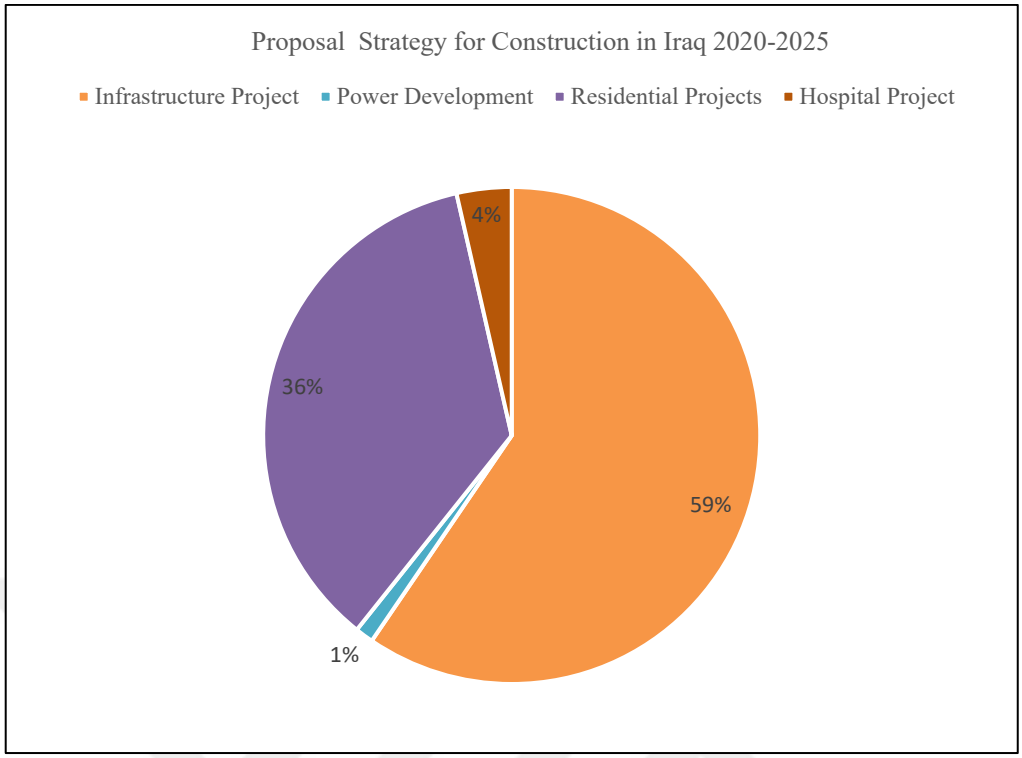

Figure 2.2: Proposal Strategy for Construction in Iraq 2020-2025.

In addition, the questionnaire survey performed as part of this study provides ample evidence that immediate shipment from everywhere is a significant bottleneck. The inherent paucity of materials causes delays in the process, often for indefinite amounts of time.

2.3 CONSTRUCTION SECTOR DELAYS

One of the most critical challenges faced by the construction industry is the occurrence of delays, which can potentially result in severe and far-reaching consequences. The outcome of construction projects is inherently connected to the occurrence of delays. The construction sector will encounter obstacles as a result of various contributing factors. Delays are a prevalent occurrence in projects, regardless of their size or complexity. Construction delay is described as the amount of time spent on a project that is longer than the deadline set forth in a contract or the deadline agreed upon by all parties [13].

Despite the utilization of advanced tools and technologies, numerous construction projects continue to encounter setbacks. Numerous unanticipated obstacles have arisen, encompassing factors such as the absence of dependable suppliers or communicators, inadequate managerial capabilities, insufficiency of materials, financial challenges,

alteration requests, equipment malfunctions, occurrences of force (natural catastrophes), and other similar circumstances. The intricate interconnectedness of delays further contributes to the intricacy of the problem [13].

It is a commonly acknowledged fact that delays in the construction of projects are unavoidable, albeit with a considerable range in their duration, spanning from a few days to several months or even years [14].

2.4 CONSTRUCTION DELAY: A CHARACTERIZATION

Delay is a prevalent issue in construction projects that is characterized by its high cost, intricate nature, and inherent risks [15]. The definition of construction delay [16] has been derived from numerous investigations and research endeavours. Several scholarly articles have identified time overruns as the primary factor leading to budgetary and scheduling delays in construction projects [17].

The occurrence of project delays within the designated timeframe (where delay refers to a deceleration in work progress without a complete cessation) represents a significant concern within the construction industry [18], [19].

Another definition of delay is the prolonged duration of construction due to setbacks experienced throughout the execution process [20]. Hasan et al. (2014) propose a classification of building delays into two distinct categories: delays resulting from situations that may be anticipated, and delays resulting from unforeseen events. Rahman (2014) categorizes delays into two distinct groups: justified (or acceptable) delays and unjustified delays. According to Alotaibi [21], delays refer to occurrences that result in the extension of the project's duration beyond the initially anticipated timeframe. The occurrence of a delay leads to financial losses and the unavailability of essential infrastructure for the proprietor. Contractors experience financial losses due to the necessity of investing in costlier tools, procuring additional supplies, recruiting more personnel, and encountering project delays [22].

In the context of this research, a delay in a construction project can be operationally defined as the malfunction to realise completion of crucial project purpose activities within the

designated timeframe. The investigation will primarily focus on the significant scarcity of building supplies.

2.5 DELAYS IN CONSTRUCTION BY TYPES

Numerous scholarly investigations and study endeavours have endeavoured to ascertain and categorize the prevailing types of delay on a global and regional level. Contractual frameworks facilitate the categorization of delays into four overarching types, as elucidated by Ahmed [23], Menesi [24], and Hamid [25].

a. Non-excusable delays refer to delays in a project or process that are not considered justifiable or acceptable. These delays are typically caused.

b. The term "excusable" refers to a situation or action that can be justified or pard non-compensable delays refer to delays in a project that are not eligible for compensation or additional time. These delays may arise due.

c. The topic of discussion pertains to delays that are both excusable and compensable in nature.

d. The topic of discussion pertains to concurrent delays.

Each type has a simple definition, which is given below:

a. Delays that are primarily the fault of the contractor or the suppliers they utilize as a result of an occurrence falling under the contractor's purview are known as non-excusable delays.

b. The term "excusable" refers to a situation or action that can be justified or pard non-compensable delays refer to situations where neither the owner nor the contractor can be held accountable for the occurrence of the delay. For instance, an occurrence attributed to a divine intervention.

c. The concept of an excusable compensable delay refers to a delay in a project that is attributable to the owner or the agent acting on behalf of the owner.

d. Concurrent delays occur when multiple delays coincide, resulting in independent or cumulative impacts.

Construction material is a significant factor contributing to delays, encompassing several forms of delays [25]. The scarcity of materials may arise from factors such as owner or contractor negligence, mishaps, acts of nature, or other causative factors. Effective material management is crucial for the efficient control of delays. Table 2.2 will present the various qualities and types of delays, while the explanation of each type will also be provided.

Table 2.2: Characteristics and Forms of Delay.

Categories of Delay	Characterization
Connected to work.	There is a scarcity of labor, an inadequacy of qualified workers, and a notable deficiency in labor productivity.
Consultant-related (excusable, commendable delays).	The identified issues include a deficiency in experience, untimely submission and approval of papers, inadequate communication, insufficient inspection, and errors in the design and drawings.
Contractor-related (non-excusable delays).	The issues identified include financial mismanagement, inadequate management practices, insufficient experience, compromised safety measures, inadequate training protocols, subpar communication practices, incorrect building methods, and a shortage of qualified personnel.
Delays of various kinds related to material.	The issues at hand include a scarcity of workers, a workforce lacking qualifications, suboptimal labor productivity, and the need for training.
Owner-related (excusable, commendable delays).	The process of decision-making, temporary cessation of work, reviewing and granting approval for the document, financial matters, alteration of the order, and site delivery.

Numerous scholarly investigations have attempted to identify the predominant causes of construction delays. Although the outcomes exhibit variability contingent upon project characteristics and disciplinary focus, a multiplicity of probable rationales exist to elucidate the occurrence of schedule overruns in construction endeavours. This study examines construction delays that have occurred in a variety of building initiatives around the world. Table 2.3 provides an exhaustive summary of this study's findings, outlining 43 unique factors that have been identified as contributors to construction project delays[26].

Table 2.3: Delays in the Globally Construction Sector.

No.	Factors causing construction delay
1	Bureaucracy in Government agencies
2	Changes in government regulations and laws
3	Delay in approving material samples
4	Owner's delay in confirming shop drawings
5	Delay in equipment delivery
6	Delay in issuance of change orders
7	Delay in obtaining permits from Municipality
8	Delay in progress payment by owner
9	Economic instability
10	Effect of weather
11	Inadequate Contractor Experience
12	Inadequate project planning in the beginning.
13	Improperly early project schedule.
14	Weak project organization.
15	The contractor did not effectively monitor the project's progress.
16	Interference by owner in construction operations
17	Labour Absenteeism
18	Lack of high-technology mechanical equipment
19	Lack of high-technology mechanical equipment
20	Lack of teamwork
21	Land acquisition
22	Land acquisition
23	Late in approving design documents by owner
24	Logistic access to site
25	Excessive reliance on the lowest bidder when choosing a contractor.
26	The owner's lack of cooperation with the government during the planning phase.
27	The owner's lack of cooperation with the government during the planning phase.

Table 2.3: Delays in the Globally Construction Sector "Table Continued".

28	Political insecurity
29	Poor communication between owner & others
30	Poor administration of contracts.
31	Redesign is required since the work was of poor quality.
32	Lack of construction supplies.
33	Shortage of manpower
34	Shortage of Technical Professionals
35	The owner's decision-making process is too slow.
36	Work is put on hold.
37	The project's scope is not well-defined.
38	Traffic control of the project
39	Type of construction contract
40	Unqualified workforce
41	Unrealistic contract duration
42	Unrealistic requirements imposed
43	Variations orders

In Table 2.3 does not comprehensively encompass all the factors contributing to the delay in the building projects; nonetheless, it does accurately depict certain key causes. This variation in reasons can be attributed to the unique nature of each project and the specific conditions associated with it. The objective of the research conducted in Iraq is to establish a correlation between political instability and the subsequent hindrance of development progress inside the nation. The protracted duration of the Iraq war, spanning from 2003 to 2022, exerted a notable influence on the scheduling and successful execution of several undertakings. In accordance with the statement. Table 2.1 presents numerous factors contributing to construction delays, with particular emphasis on material shortages and challenges associated with various types of materials as the main focal point of this study.

2.6 BAD IMPACTS OF DELAYS ON BUILDING PROJECTS

Construction delays have been found to have an impact on both the time and expense of a project [27]. The construction business worldwide has witnessed a prevailing trend of experiencing overruns in both cost and schedule, which are often accompanied by various claims. The presence of claims is an unavoidable occurrence, leaving us with the inquiry of their level of seriousness [28]. In the realm of construction, the evaluation of success is commonly predicated upon the extent to which a project is accomplished within the designated timeframe, financial parameters, and desired standards of excellence. Despite previous assertions, the principal obligation of a project manager in the construction industry is to ensure adherence to the project's allocated budget and timeline. Drawing upon prior research and scholarly investigations and acknowledging the significant issues persisting in the construction industry, the forthcoming chapters will undertake an examination of the consequences associated with the failure to meet schedule and financial constraints.

2.7 OVERRUNS IN PROJECT SCHEDULES

Missed deadlines, often known as time overruns, represent a significant challenge within the global construction industry. The timely completion of a project is the primary determinant of its overall success. The construction time overrun refers to the discrepancy between the initially specified contract duration determined during the tendering (bidding) process and the final contract length established upon the completion of the construction project. Time overruns in construction projects can have significant implications, encompassing several negative outcomes such as escalated expenses, reduced efficiency, contract terminations, expedited work leading to compromised quality, and conflicts among project stakeholders. Delays in project completion are a prevalent concern within the construction sector, affecting both developing nations and well-established ones such as the United States and the United Kingdom.

Delays occur in over 40% of building projects. It is well known that the construction sector has a poor track record of keeping to project schedules. One of the primary factors contributing to budgetary and scheduling issues in building projects is the significant absence of comprehension regarding time overrun analyses. Out of the total number of projects undertaken, only 47% were successfully completed within the designated

timeframe. According to the cited source [29], it was found that approximately 38% of building projects failed to fulfil their predetermined deadline objectives, whereas 15% of projects were completed ahead of schedule.

Regrettably, the construction business in Iraq is characterized by a negative perception of its subpar performance and inadequate ability to efficiently manage time. This phenomenon leads to substantial disruptions in the timely accomplishment of the majority of undertakings. Time overruns are a prevalent issue within the construction business, prompting numerous investigations into their underlying causes. Sugar [26] identifies several prevalent factors contributing to budget and schedule overruns, including delayed payments, insufficient availability of essential components, price variations of those materials, inadequate site management, and indecisiveness. Factors such as owner intervention, unanticipated challenging terrain, and impromptu modifications made by the owners can also contribute to the prolongation of project timelines. Prior studies have established a correlation between these parameters and the occurrence of schedule delays [30]. The persistent occurrence of schedule overruns in impoverished countries can be attributed to various factors, including a dearth of experience, inadequate management practices, insufficient availability of supplies, and inadequate planning.

2.8 DELAY-DETERMINATION STRATEGIES

Various methodologies have been employed to ascertain the magnitude of project schedule disruptions. In the subsequent paragraphs, we will examine many prevalent methodologies.

2.8.1 The Critical Path Method

It is generally agreed upon that the Critical Path Method (CPM) is the best strategy for assessing the effects of a schedule deviation [31]. The process of delay analysis commonly involves comparing the initial schedule with the present status [32]. This study examines three commonly employed methodologies for delay analysis. There are other approaches that can be employed, namely the "what-if" method, the "but-for" approach, and the CPA approach, which stands for contemporaneous period analysis. The measurement of delay effects is conducted in relation to a distinct baseline schedule for each individual case. The

examination of schedule implications can be conducted through the utilization of the CPM [33].

The comparison of the “as planned” scheduled and the “as built” schedule is the main technique used in delay analysis. Three widely used delay analysis approaches were examined in this article. The “but-for” strategy, the “what-if” method, and Critical Path Analysis (CPA) are the three most often applied techniques. In each case, the evaluation of delay consequences is carried out regarding a distinct baseline schedule.

2.8.2 Scenario Analysis

The what-if methodology employs the anticipated or intended chronology as its initial reference point. Initially, the temporal setback is attributed to a singular entity and thereafter incorporated into the preexisting timetable. The duration of the project is determined by factoring in the additional time required due to these obstacles. In order to compensate for the time that has been wasted as a result of the involvement of the other party, it is necessary to repeat this operation. The amount of the overall project delay which can be attributable to each relevant party was finally calculated through analysis [34].

2.8.3 If-Only Reason

The utilization of the current construction timeline serves as a first reference point. The aforementioned strategy is deemed superior to the what-if method due to its ability to consider and accommodate potential changes in the project timeline and budget. The methodology involves utilizing the existing timetable and deducting the delay created by the owner. The distinction between the as-built timetable and the but-for schedule lies in the presence of condensable delay [34].

2.8.4 CPA, or the Method of Contemporaneous Period Analysis

CPA technique involves the subdivision of the construction timeline into smaller time intervals, allowing for the examination of the effects of delays on each project stakeholder in real-time. This methodology effectively characterizes and measures construction project delays. The first established schedule serves as a baseline, but it undergoes revisions with the completion of each scheduled time increment. These revisions are made in order to

maintain adherence to the timetable, with the updated version serving as the subsequent starting point. According to Arditi [35], the schedules will be consistently updated till the completion of the project. Due to the method's capacity to categorize project delays into compensate, non-excusable, and excusable non-compensable delays, courts have generally accepted it for timetable delay analysis [35].

An extension of a project's timetable signifies that the actual implementation phase exceeded the originally estimated duration, as supported by previous research and empirical evidence. The observed alterations in the timetable serve as an indication of a project's postponement, so suggesting that justifications for delays may vary depending on the specific circumstances[36]. However, other factors contribute to the deceleration of the project. Nevertheless, it should be noted that there is a lack of consensus within the construction industry regarding a standardized approach for quantifying the financial impact of delays resulting from change orders or unforeseen circumstances.

2.8.5 The Increase in Project Costs

The construction industry and engineering sector have historically faced significant challenges in relation to two interrelated issues that have a detrimental effect on their projects: cost overruns and timetable delays. The matter pertaining to the escalating cost associated with significant undertakings has garnered considerable prominence in recent times. Given the absence of cost reductions throughout the course of the last seventy years, it is expected that there will be an average increase of 28% [37]. According to Park [38], it has been demonstrated that excessively optimistic time and cost forecasts have a detrimental impact on both the quality and productivity of construction projects, persisting even after the final product has been completed. The existing body of knowledge is inadequate because it primarily examines the critical success factors associated with time and cost as discrete concepts across a range of project types and geographic regions.

The examination of cost performance in building has been the focus of significant research in recent decades. The occurrence of budget overruns is predominantly observed during the building phase due to the emergence of numerous unforeseen obstacles throughout the planning and design stages [39]. During the implementation stage of projects, excess expenses can be ascribed to various notable variables, specifically ineffective site

administration and supervision, slow decision-making procedures, and modifications initiated by the client [40]. The occurrence of supplementary fees is a direct outcome of any prolongation in the duration of a project. Therefore, it is crucial to recognize and consider these aspects.

The effective administration of various resources such as individuals, equipment, cash, materials, and processes is a fundamental aspect of project management [40]. There have been assessments conducted to examine the influence of these factors on project delays and the correlation between delays and cost escalation in the project, because of employing tools and methodologies to get further insights into the adverse elements indicated by the source referenced as [41]. Iraqi construction projects continue to experience significant delays, which remain unaddressed, resulting in escalated costs and occasional project failures.

2.9 CONSTRUCTION PROCESSES

Any substance utilized in the construction process can be classified as a construction material. The construction process is cantered on the utilization of construction materials. The commencement of any construction project is contingent upon the availability of essential materials[42].

After the military intervention in 2003, Iraq developed as a significant hub for the procurement of construction materials. The demand for fresh content in the marketplace is constant. Adjacent nations initiated the transportation of construction materials to Iraq, while prominent enterprises in adjacent countries shifted their focus solely towards serving the Iraqi market. The market's current fragile condition can be attributed to a multitude of issues, encompassing unstable political circumstances, inadequate government regulations, insufficient security measures, uncertain border laws, continuously growing codes and code requirements, inexperienced and ineffective management practices, a volatile stock market, and monetary challenges. Project delays occurred anytime there were complications within the materials department[43].

As previously said, materials have a significant role in both planned and unforeseen delays. Material markets are consistently confronted with a multitude of social, political, and economic difficulties[44]. The local market had unhindered growth due to the presence of political and governmental instability. During the period from 2003 to 2010, the primary

challenge faced by the market was the necessity to adjust to changing production sources in response to the evolving requirements of specific projects.

Delays during construction can be ascribed to a diverse range of variables, encompassing deficient management, inadequate labor resources, suboptimal labor productivity, insufficiency of materials, hazardous site conditions, political instability, and other contributing elements[45]. This phenomenon was particularly evident in Iraq during the period from 2003 to 2016, characterized by the prevalence of a multitude of war-related risks and dangers. The building sector saw significant adverse impacts in the aftermath of the conflict. Today, our focus lies on Iraq, specifically examining the impact of insufficient resources on the pace of construction activities. Historically, building supplies have held a significant and indispensable position within the fabric of Iraqi society. The impact of the building sector can be observed in its role as an economic entity, a social determinant, and a political influencer. Before 2003, Iraq played a significant role in the production of construction materials, boasting an extensive network of production facilities that catered to the entire nation[46]. Currently, Iraq is experiencing a phase of transformation. The region provides a conducive environment for international investment and exhibits significant prospects.

2.10 MANAGEMENT OF CONSTRUCTION MATERIALS

The management of building materials involves several elements, including takeoff, procurement, expediting, receipt, storage, and transportation. Insufficient control and management within these domains can lead to shortages or surpluses of materials, as well as cash flow challenges. The occurrence of delays in personnel and equipment can result in significant financial costs, while shortages may arise due to insufficient quantities or inadequate quality of materials that are not readily accessible at the required time[47]. The central emphasis of every project should be on the training process, the production of preconstruction materials, and the orientation of staff. The material management system is dependent on a complex network of online computer systems for coordination. To mitigate the occurrence of shortages, surpluses, and cash flow difficulties, it is imperative to implement appropriate measures, albeit at a considerable cost [48].

According to the Business Roundtable [49], material management can be defined as the systematic process of planning and regulating activities to assure the availability of appropriate quantities of materials at the required time. The attainment of material standards that are timely, precise, and cost-effective is accomplished.

According to the study, an estimated $82 billion was allocated towards the procurement of materials for the purposes of manufacturing, commercial, and electrical plant building in the year 1979. According to the research findings, it is suggested that a potential reduction of over 6% in overall construction labor expenditures could have been achieved if there had been adequate maintenance of essential supplies [50], [51].

In Iraq, there is a vast construction movement. Still, it is accompanied by many problems, the most important of which is the delay in completing projects during the specified time. The time must be optimized by adopting leadership practice and dedicating it to the benefit of performing the process and functions of the project. The research aims to identify the most important reasons and factors that affect the project delivery process within the specified period [52]. The investigation initially dealt with the most important previous studies, on this subject, by researchers, then touched on the concept of construction projects, their types and details. A questionnaire containing reasons for the delay was identified and divided into several items. It concluded that the most common reasons for delays are delays in laboratory testing of materials, assignment of works to the lowest bidder, contractors' financial incompetence, and high building materials prices [53]. The most crucial factor is to streamline building material inspection procedures, set up inspection laboratories on several occasions and assess the contractor's effectiveness and ability to implement before the project is referred financially. Organizations and individuals should coordinate their work between the construction departments to prevent any issues that may arise during completing tasks [54].

There are several problems facing the construction industry in Iraq. Delays in construction projects affect one of the most important factors in project success, namely time [55]. This delay causes many problems such as increasing the cost of the project, lack of timely operation, and on a larger scale, economic and social impact on the country. As being one of the metropolises of Iraq, the city of Najaf needs a lot of development projects in the development path [56]. Public school construction projects are an example of projects

needed in the city, and delays in these projects in recent years have sometimes caused the city's schools to operate on a mixed basis. This study deals with studies and researches related to the delay of construction projects in other countries, and after interviews and surveys of construction industry stakeholders in Iraq, new factors have been obtained and finally, using the opinions of the mentioned experts, prioritizing the factors extracted from both identified the source and the five main causes of project delays, including late payment to the contractor, design errors, construction length errors, problems with neighbors, and inexperience of contractors [57], [58]. In the next step, the amount of delay due to the main factors identified in the projects was analyzed using the official documents of 30 sample projects from the statistical population of completed school construction projects in Najaf city. Statistics on the amount of delay caused by factors and comparing it with some indicators, the need to use contractors with better ratings, skilled manpower, experienced project managers, and the number of suffici [59].

This essay aims to highlight the most important issues and difficulties facing implementing large projects that follow the turn-key method, considered one of the types of contractual methods in Iraq, especially for large and complex projects requiring speedy completion. The projects implemented in this way face delays and delays in completion, which led to the lack of benefit from the projects for which they were implemented, especially those affecting the lives of citizens within the health sector [60], [61]. The case study dealt with the construction of hospitals with multi-bed capacities within multiple governorates in Iraq, With large financial allocations within the federal budget of the Government of Iraq over several years. After conducting a descriptive statistical analysis of the data obtained through a field survey and interviews with individuals working in the construction sector with experience in their field [62]. The most important 10 factors were identified from a list of 51 delay factors (distributed according to the questionnaire forms) with a high RII [63], [64], [65]. These factors were related to the delay in the payment of the contractor's dues, the delay in processing materials, the issuance of new instructions and regulations, the delay in obtaining official approvals from the relevant authorities, Errors in designs or contracting documents, lack of cooperation between the contracting parties, and multiple spare orders for reasons belonging to the employer [66]. The article also included the most important suggestions that contribute to reducing the delay in completing projects.

In this study, the reconstruction tactics, as well as the delays in time and cost that were induced by various delay factors, are discussed in relation to a selection of projects occurring in Iraq (with Baghdad serving as a case study). The objective of this study is to find ways to prevent delays in construction projects, particularly in post-disaster situations, regardless of whether the disasters were caused by natural forces or by human intervention, because of the particular national and humanitarian significance of these situations [67]. Within the realm of the construction industry, we developed a set of theoretical and practical approaches for project management that deal with a variety of global and local trails [68]. The purpose of this study is to shed light on the experiences of the reconstruction industry in Iraq (using Baghdad as a case study), compare those experiences to the ones of other countries, and then return to the comparison of the theoretical framework as an integrated strategy for reconstruction in Iraq and other countries that suffer from the same circumstances and cause delays in time and cost in construction projects [69], [70]. By establishing parameters to restore balance in this study, the purpose of this research was to identify the elements that contribute to effective delays in building projects in Iraq, which have an impact on both the amount of time and the specific quality cost. Additionally, the research aimed to uncover the most effective strategies to address delays and solve the problem[70]. For the purpose of this investigation, a sample of thirty projects from a variety of departments within the construction industry was chosen. The selection of these initiatives was based on the varying degrees of vulnerability that they exhibited [71]. This study chose to focus on twelve different delay factors [72]. As a case study, Baghdad served as the focal point of the investigation, which concentrated on the most prevalent and recurrent causes of delays in construction projects in Iraq. Owner failure (O.F.) and newly added holidays (HO) were the elements that caused the delay[73].

2.11 CHAPTER OUTCOMES

This chapter presents a summary of the results derived from a comprehensive literature review conducted to enhance understanding of the complexities of construction delay, including the primary factors which contribute to its presentation. An extensive review regarding the Iraqi construction sector was given in the first portion of this chapter. Additionally, the study encompassed an extensive examination of previous scholarly investigations conducted worldwide. Besides, a literature study of previous studies

highlighted the factors that contribute to building delays, which were also discussed. This paper examines the utilization, applications, and impact of construction materials on various projects, alongside their corresponding management strategies.

3. METHODOLOGY

3.1 INTRODUCTION

Numerous enterprises in the construction sector experienced closure as a consequence of the Iraq war crisis in 2003, as indicated by the aforementioned study and examination of relevant literature. Following the conflict, Iraq commenced a dependence on imports from other nations, including Iran, Turkey, Jordan, and Saudi Arabia, to fulfil its building supply requirements. The occurrence of war resulted in numerous challenges for the industry, encompassing both expected and unexpected consequences. As a consequence, the market for construction supplies became exceedingly responsive to political factors within importing nations, leading to unfavorable outcomes for construction marketing. The study focused on survey questions and responses pertaining to the importation of items from countries other than Iraq.

3.2 SUGGESTIVE METHOD

A number of actions are included in the systematic process that is depicted in Figure 3.1. These activities include acquiring, examining, questioning, analysing survey findings, engaging in discourse, and offering solutions for the challenges that are faced in the Iraqi construction industry [74]. For the purpose of determining the amount to which material shortages contribute to delays in relation to other relevant factors, this study utilised a qualitative research approach [75]. The review of the literature included scholarly papers, professional reports, and records from the government as part of its scope. A version of the first document was made in order to conform to the recommendations made by subject-matter experts after consultation with those experts[76].

This research utilised a quantitative approach, which included the creation of a survey questionnaire and its subsequent utilisation for the purpose of data collection [77]. After that, statistical methods were utilised in order to conduct an analysis of the information that was acquired, with the objective of determining the primary variables that are contributing to the limited availability of materials within the building industry[78].

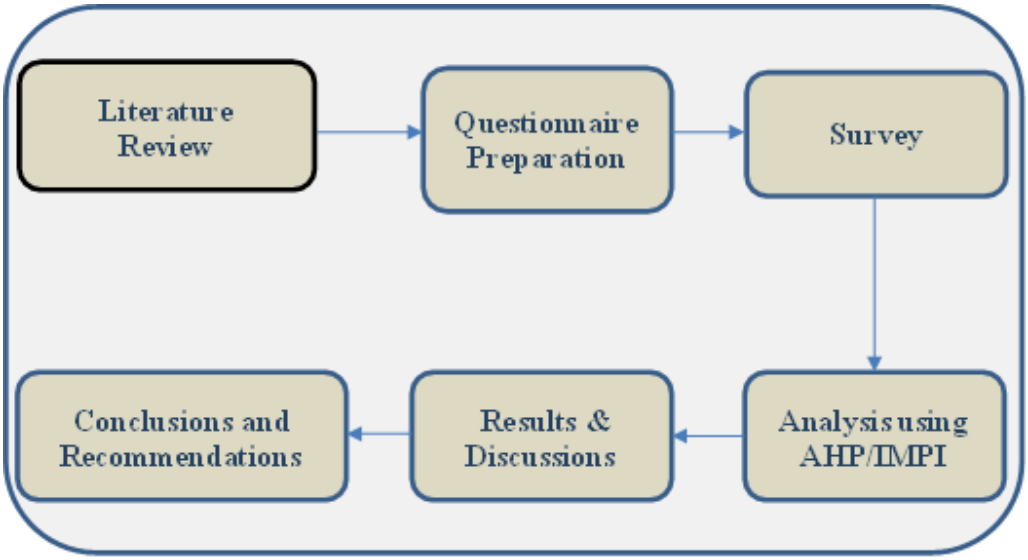

Figure 3.1: Techniques Sequential Procedures.

3.2.1 Test of Analytic Hierarchy Process

We used an AHP comparison to analyse the results of the survey questionnaire. This comparison was based on the respondents' overall construction experience, job assignment, industry sector, and company type. According to the findings of the investigation, there are seven distinct categories of individuals who are capable of performing the role of responder. There are many different types of people who work in the construction sector, including engineers, project managers, experts, subcontractors, professors, and suppliers [79]. Due to the fact that email was utilised as a method of communication, they were granted permission to take part in the study[80].

There are two parts to the survey:

a. The significance of material shortages in light of the twenty most important causes of delays that have been identified.

b. Analyse the factors that contributed to the respondents' inability to obtain the necessary supplies. In this part, we list the 27 causes discovered from the literature research that are thought to account for construction material shortages and project delays. The groupings reflect the results of prior investigations, official government reports, and the thoughts of recognized authorities in the field. The participants were asked to rate the characteristics

using one of five choices. Where (1 = Significantly Less Significant), (2 = Less Significant), (3) = Significant, (4) = More Significant, and (5) = Significantly More Significant.

The participants may have been instructed to assess the importance of a technical problem as either "important" or "unnecessary" based on how much a shortage of building supplies would affect the overall success of completing construction projects [81].

The survey was sent to several individuals who hold influential positions in the construction sector [82]. All fifty participants who were asked to participate in the study accepted the request to take part in the survey [83].

3.2.2 A Statistical Method to Factor Ranking Testing

The Importance Performance Index (IMPI) is used in the second test to evaluate the lack of material components and how it relates to other delays-causing elements. The primary objective of conducting this test was to augment the existing pool of test data and results, while also ensuring that the survey findings are subjected to distinct treatment across various test types, so rendering it suitable for multiple testing purposes.

The approaches necessary to successfully complete the IMPI examination were categorized into two distinct components. In the first phase, the Frequency Index (FI) was determined using Equation 1. In this case,

$$FI\% = \sum a\left(\frac{n}{N}\right) \times \frac{100}{4} \tag{3.1}$$

Were,

a= Each response is given equal weight (Ranges between 1 and 5).

n= The response's frequency.

N= Number of total responses.

The survey will be conducted in accordance with the standards outlined in Table 3.1 for FI.

Table 3.1: Record of Frequency Indexes.

Fl.no	Significantly Less Important	Less Important	Important	More Important	Significantly More Important
1	a=1	a= 2	a= 3	a=4	a=5

The determination of the Severity Index (SI) will be conducted in the second phase by employing the SI formula.

$$SI\% = \sum a\left(\frac{n}{N}\right) \times \frac{100}{4} \tag{3.2}$$

Were,

a= Each response is given equal weight (Ranges between 1 and 5).

n= The response's frequency.

N= Number of total responses.

Various labels were employed to designate the criteria in accordance with the survey methodology of the study; nonetheless, all of these titles shared a common underlying rationale and significance. The relative significance of the conditions for the Frequency Index was determined by ranking.

In the subsequent phase of the procedure, the criteria outlined in Table 3.2 will be implemented.

Table 3.2: Record of the Severity Index.

Sl.no	Significantly Less Important	Less Important	Important	More Important	Significantly More Important
1	a=1	a= 2	a= 3	a=4	a=5

The questionnaire organise of the research project incorporated multiple terminologies for the criteria, albeit these labels were used interchangeably and held equal importance. The criteria were organized based on their respective levels of relevance, hence determining their eligibility for inclusion in the Severity Index.

The formula proposed will be utilized in order to implement IMPI.

$$\text{IMPI } \% = \frac{\lfloor FI\% \times SI\% \rfloor}{100} \tag{3.3}$$

The results are presented in below Table 3.3.

Table 3.3: IMPI Result.

No.	SI%	FI%	IMPI%
1	Outcome	Outcome	Outcome

3.3 QUESTIONNAIRE RESULTS

The questionnaire is divided into Many parts. The initial segment was considered with the purpose of assessing variables contributing to delays in material shortages. A selection of twenty primary variables was made to encompass the prevalent issues within the building business in Iraq. Table 3.1 presents an overview of the elements contributing to delays, as identified through the analysis of recommendations, discussions, and opinions provided by the construction experts participating in the survey.

The data pertaining to the second phase of the study was gathered to assess the primary factors contributing to the scarcity of building project materials. The data was obtained from several sources, including government agencies, subject-matter experts, organizations associated with the building industry, and scholarly publications. The provided information encompasses four primary domains, including technical challenges, concerns regarding governmental rules, issues pertaining to management, and challenges related to experience.

Table 3.4: Principal Causes of Construction Project Delays in Iraq (Not Specified).

No.	Delay-causing Factors
1.	Contract duration that is too long.
2.	The project's scope is not precisely specified.
3.	Weak administration of contracts.
4.	Lacking project designing in the start.
5.	Improperly initial project schedule.
6.	Owner's late approval of design documentation.
7.	Work is put on hold.
8.	Owner's tardy progress payment.
9.	The owner and other parties' poor communication.
10.	Poorly managed site.

Table 3.4: Principal Causes of Construction Project Delays in Iraq (Not Specified) "Tables Continued".

11.	Staff from the contractor assigned to the project have poor qualifications.
12.	Lack of resources.
13.	Equipment delivery is delayed.
14.	Delay in acquiring municipal approvals.
15.	Result of the weather.
16.	Plan traffic management.
17.	Political security-related issues.
18.	Economic stability issues.
19.	Modifications to laws and regulations.
20.	Consequences of subsurface circumstances.

Table 3.5: Engineering Factors Causing a Material Shortage (Not Specified).

No.	Technical Causes
1.	The customs office's lack of precise construction material criteria.
2.	There is a lack of precise code requirements for building materials at the customs office.
3.	lack of knowledgeable staff at customs to interpret code requirements.

Table 3.6: Experience-Related Factors Causing a Material Shortage (Not Specified).

No.	Experience Causes
1.	unable to regulate the cheap and low-quality materials on the market.
2.	The production plant's lack of management or oversight experience.
3.	Inadequate management of the current production facilities by owners or investors.
4.	Absence of an expert consultant or assessment of the quantity of material required.
5.	Contractors without the necessary expertise to manage construction supplies on site.
6.	There is no advisor to let ordering organizations know what materials are available on the market.

Table 3.7: Management Factors Causing a Material Shortage (Not Specified).

No.	Managerial Ethics
1.	Absence of supplies for construction materials.
2.	Lack of market-relevant code changes.
3.	Lack of a mechanism for managing project materials.
4.	Lack of guidance on the requirement for material throughout project operations and outdated inventories.
5.	Improper planning for the storage of construction materials.
6.	Materials for the project are not stored properly.
7.	Lack of dialog between the consultants and contractors regarding updates to the availability of materials.

Table 3.8: Causes of a Material Shortage Caused by Government Laws (Not Specified).

No.	Causes of Government Laws
1.	Imports of building materials are not subject to restrictions on certain brands or producers.
2.	Government regulations on the sale of construction materials are lacking.
3.	Government regulations on imported materials for building specifications are absent.
4.	Uncertain material requirements set forth by government code.
5.	Every government location has a different set of specifications for building materials.
6.	Government project requirements are constantly changing.
7.	The closure of nearby manufacturing facilities.
8.	Corruption that made it impossible for producers to profit from the imports they received.
9.	Lack of government backing for the enterprises producing private construction materials.
10.	Government plans to manage the factories producing public construction materials are lacking.
11.	Government initiatives to create or expand new factories producing building materials are lacking.

3.4 ANALYTIC HIERARCHY PROCESS

Outlined AHP, a useful tool for handling complex decision-making situations. This approach assists decision makers in effectively prioritizing alternatives and ultimately selecting the most ideal choice. AHP successfully combines the subjective and objective components of a process of decision-making by performing a sequence of similarities between pairs and then combining the outcomes. Furthermore, AHP encompasses a valuable methodology for guaranteeing the decision maker's consistency in their evaluations, so mitigating bias and facilitating the generation of well-informed choices.

3.4.1 Advantages of AHP

The utilization of AHP as a decision-making tool can be advantageous for construction managers and those involved in critical decision-making processes. When using the AHP, the user must create a hierarchical framework for the current situation. This process entails the analysis of the issue, the evaluation of alternative decision criteria, and the selection of the most crucial criterion in connection with the choice's objective. Pairwise comparisons are a valuable tool for identifying and rectifying logical inconsistencies. The approach additionally facilitates the conversion of qualitative notions, such as preferences or emotions, into quantitative relationships. The utilization of AHP has been found to enhance the level of clarity and transparency in decision-making processes.

3.4.2 Method of AHP

The proposed approach is contingent upon the successful resolution of a mathematical problem known as the Eugen value problem. The array depicts the outcomes of the comparisons made pairwise. The first standardized right eigenvector in the array designates the ratio scale, which is additionally known as weighting. The determination of the percentage of consistency is based on the utilization of the Eugen value.

3.4.3 The Procedures of AHP

Thomas L. Saaty [55] developed the AHP as a method for systematically generating the priorities required to arrive at a sensible solution to a challenge.

a. The primary objective is to accurately identify the central problem and articulate the specific requirements for information.

b. The selection criterion should be positioned at the apex of the decision hierarchy, and the objectives ought to be scrutinized in a top-down manner, culminating in the identification of a range of potential choices.

c. Construct a array that facilitates a comparative analysis of each pair. In the hierarchical structure, each element at a higher level undergoes a comparative analysis with its antecedents in the level immediately below.

d. Immediately include the priorities produced from the comparison process while evaluating the different levels. Please iterate this process for every individual component. Subsequently, the determination of the relative significance of each component is achieved through the summation of the assigned values from the preceding tier. Continue executing this process iteratively until a hierarchical arrangement of the alternatives is obtained, with the lowest level indicating their respective rankings.

3.4.4 AHP Characteristics

The adaptability and utility of AHP stem from its reliance on the user's subjective pairwise relative evaluations of criteria and alternatives to calculate scores and ranks. AHP is a methodology used to turn decision-makers' evaluations—which cover a mix of qualitative and quantitative aspects—into a ranking system that considers several factors. The decision-maker's knowledge and experience continuously serve as guidance for the computations in AHP. The utilization of AHP levels already encompasses the decision maker's expertise, hence eliminating the need for a complex expert system in the process.

On the other hand, while employing AHP, the user may be required to make many arbitrary choices, particularly in situations in which there is a great deal of alternatives and factors to consider. In each evaluation, the person making the decision is required to offer an explicit comparison between two possibilities or criteria. However, the end outcome of this process may be irrational because of its cumulative effects. The quantity of pairwise comparisons that are required develops in a manner that is quadratic in nature whenever additional options and criteria are considered. When analyzing a collection of 10 probable outcomes based on 4 criteria, selecting the weight vector requires 6 comparisons. Because of this, there will need to be 180 pairwise comparisons for the score array, which may be calculated by multiplying 4 by the total of the numbers ranging from 1 to 9. It is possible to automate AHP by defining proper thresholds that allow the computer to decide on particular pairwise comparisons in place of the decision maker. This allows AHP to be carried out in a more time – efficient manner.

3.4.5 The AHP Method in Practice

AHP can be executed through a series of three straightforward and sequential stages:

a. The process of determining the vector of requirement ratings.

b. The process of calculating the array of alternative ratings.

c. Evaluating and prioritizing the available alternatives.

3.4.6 Programs for AHP

There exists a diverse range of AHP solutions accessible on the internet, which can be utilized to facilitate the decision-making process. These tools facilitate the user in making both complex and routine judgments that arise in their daily professional activities. AHP is widely utilized in various contexts worldwide. Table 3.9 provides a comprehensive overview of the objectives of each AHP program and its potential synergies with project management in diverse applications. The evaluation of suppliers is a crucial aspect in various domains, such as project management, the employment process, and the assessment of a company's success. This study will employ IMPI analysis techniques to analyze the survey data.

Table 3.9: AHP Projects.

No..	Project	Function
1.	Group AHP Session	Attend group sessions for AHP.
2.	AHP Structures	Create comprehensive hierarchies, then assess options and priorities.
3.	Priority Calculator AHP	Priorities should be determined using pairwise comparisons.
4.	AHP Projects (AHP-OS)	Finished AHP tasks, plus those that need grouping decision-making.

3.4.7 Infrastructure AHP

The graphic presented in Figure 3.2 provides a simplified illustration of AHP approach, which encompasses five distinct stages of analysis. By conducting a comparative analysis of data at different levels of aggregation, a full understanding of the issue of building material scarcity was achieved. The labels in Figure 3.2 for each phase and level are clear and distinct.

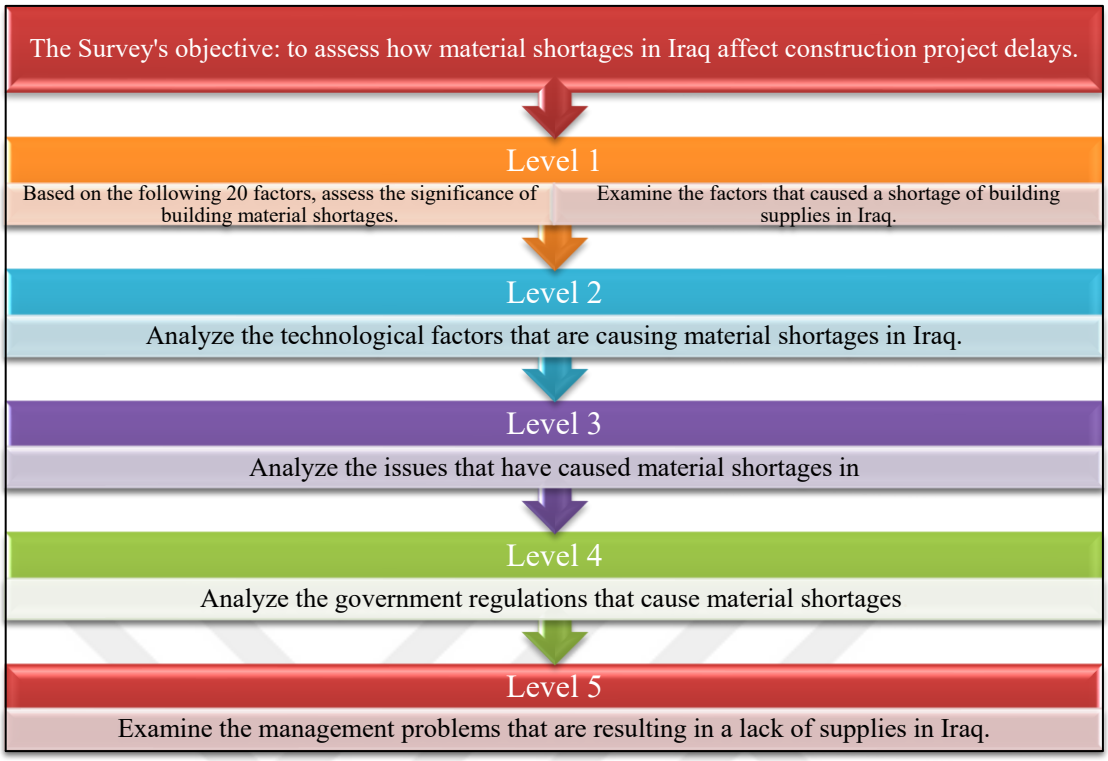

Figure 3.2: Iraq Evaluates Shortages of Building Materials and Other Concerns Using a Five-Level AHP Framework.

3.4.8 AHP Calculations

AHP was employed to ascertain the prioritization of financial factors. The subsequent passage provides a concise overview of the calculations conducted utilizing AHP income data.

The data in the comparison table was utilized to conduct three levels of computations pertaining to the earnings information associated with the difficulties discussed in the current thesis.

Table 3.10: Relationship Between Data and Its Explanation.

Values j and k	An explanation
1	J and K each carry equal weight.
3	J is marginally more crucial than K.
5	J has higher significance than K.
7	Strongly, j is more significant than k.
9	Undoubtedly, j is more significant than k.

The variables J and K stand in for the two sets of income data that are being considered. The equations offered by Saaty (2008) can be used to create the vector of criteria weights.

$$a = \frac{ajk}{\sum_{i-1}^{amk} k} \tag{3.4}$$

$$wj = \sum_{i-a}^{m} \frac{ajl}{m} \tag{3.5}$$

Let M stand in for the array that needs to be built, with aj and ak standing in for the earnings data, for the derivative of the array, and W for the direction weight.

The latter stages of the computations involve determining the array of option ratings, as outlined.

$$S = \lceil s\ (1) \ldots s(m) \rceil \tag{3.6}$$

Let s represent the score of the examined alternatives, S denote the score array, and I and J represent the criteria of the array. The final stage of the computation process involves the ranking of the options, which is accomplished by employing the equation proposed.

$$v = S.w \tag{3.7}$$

Let v stand for the global score vector, S for the score array, and w for the direction weight. The methodology used in the project to establish computations using AHP software is briefly summarized in this document. The AHP software utilized in this study is known for its user-friendly interface and does not require extensive expertise to operate well. To begin, please input the quantity of elements involved in the given problem. Subsequently, input each individual factor to construct a comparison by selecting the corresponding ranking number for each difficulty. Based on the provided entries, it is anticipated that the evaluation findings would be attained.

In this case study, the initial comparison assessed the weight of material shortage in relation to the variables causing delays. The subsequent stage involved the assessment of each rationale within the designated category. The subsequent phase involved doing a comparative analysis of the significant rationales within each respective group. This allowed for the examination of the individual effects of each case on the scarcity of construction materials.

3.5 ADVANTAGES OF IMPORTANCE INDEX (IMPI)

The Importance Index (IMPI) is a metric used in various fields to assess and prioritize items, tasks, or elements based on their relative importance. Here are some advantages of using the Importance Index:

a. Prioritization: IMPI helps in prioritizing tasks or items by assigning a numerical value that represents their relative importance. This aids in focusing resources and efforts on the most critical aspects.

b. Objective Measurement: It provides a quantifiable measure of importance, which can help in making objective decisions rather than relying solely on subjective judgments.

c. Comparative Analysis: IMPI allows for the comparison of different items or tasks based on their importance. This comparative analysis aids in better resource allocation and decision-making.

d. Efficiency Improvement: By identifying and prioritizing important elements, IMPI assists in streamlining processes and workflows, thereby improving overall efficiency.

e. Resource Allocation: It helps in allocating resources more effectively by directing them toward high-priority tasks or items, maximizing the impact of the resources available.

f. Risk Management: IMPI can be used to assess the potential risks associated with various elements. By prioritizing elements with higher importance, it aids in mitigating risks effectively.

g. Decision Making: The metric offers a structured approach to decision-making, especially in scenarios where multiple factors need consideration. It helps in making informed choices by emphasizing what matters most.

h. Communication and Transparency: IMPI provides a clear and transparent way to communicate the importance of different elements within a project or process, fostering better understanding among stakeholders.

i. Adaptability: It can be adapted to different contexts and industries, making it a versatile tool for evaluating importance across various domains.

j. Continuous Improvement: IMPI can be revisited and adjusted as needed based on changing circumstances or new information, allowing for ongoing optimization and improvement.

3.6 RISK ANALYSIS

There are two types of risk analysis views in the Table 3.12 for Risk Analysis Aspects, and Table 3.13 for Risk Analysis Factors.

Table 3.11: Risk Analysis Aspect.

Aspect	Advantages	Disadvantages
Identification of Risks	Helps in identifying potential delays early	Possibility of overlooking certain risks
	Allows proactive planning for mitigation	Time-consuming process
	Enhances risk awareness among stakeholders	Difficulty in predicting all potential delays
Quantification of Impacts	Quantifies potential time and cost impacts	Inaccuracy in estimating impacts
	Facilitates informed decision-making	Relies on assumptions and historical data
	Provides a basis for contingency planning	Complexity in assessing combined impacts
Mitigation Strategies	Enables the development of mitigation plans	Implementation may not eliminate all delays
	Helps in allocating resources efficiently	Cost implications of mitigation strategies
	Minimizes project disruptions	Lack of guarantee against unforeseen delays
Project Management	Improves overall project management	Over-reliance on risk analysis for decision-making
	Allows for better risk prioritization	False sense of security if risks are not updated
	Enhances project scheduling	Continuous monitoring required for effectiveness

Table 3.12: Risk Analysis Factors.

Risk Factor	Advantages	Disadvantages
Weather Conditions	Allows for schedule adjustments	Delays may impact project timeline
Material Shortages	Potential cost savings in alternative sourcing	May cause project interruptions
Labor Shortages	Flexibility in labor management	Slowdown in project progress
Design Changes	Improved project quality	Time and cost overruns due to modifications
Permitting and Approvals	Ensures compliance with regulations	Lengthy approval processes
Stakeholder Communication	Better collaboration and problem-solving	Miscommunications leading to errors
Economic Changes	Opportunity for cost adjustments	Unpredictable budget imp

3.7 IMPORTANCE INDEX METHOD VS. ANALYTIC HIERARCHY PROCESS

Both (IMPI) VS (AHP) are tools for multi-criteria decision-making, helping you to prioritize options under complex situations with multiple important factors to consider. However, they approach this task in different ways, each with its own strengths and weaknesses:

a. (IMPI):

Concept: This method assigns a normalized weight (importance score) to each criterion by directly calculating its correlation with the overall decision objective.

Steps:

a. Identify criteria and decision alternatives.
b. Score each alternative on each criterion.
c. Calculate the correlation coefficient between each criterion and the overall objective.
d. Normalize the correlation coefficients to obtain weights for each criterion.
e. Use these weights to prioritize alternatives based on their weighted scores.

Strengths:

a. Simple and straightforward to implement.
b. Requires minimal data and calculations.
c. Useful for identifying the main drivers of the decision.

Weaknesses:

a. Assumes linear relationships between criteria and the objective, which may not always be true.
b. Ignores the pairwise comparisons between criteria, potentially neglecting their interactions and interdependencies.
c. Conduct the questionnaire accurately in order to obtain the best results.

b. (AHP):

Concept: This method structures the decision problem hierarchically, then uses pairwise comparisons to determine the relative importance of criteria and alternatives within each level.

Steps:

a. Develop a hierarchical structure of the decision problem.
b. Pairwise compare criteria within each level, assigning subjective values based on Saaty's scale (1-9).
c. Check for consistency of judgments using the Consistency Ratio (CR).
d. Calculate priority weights for each criterion and alternative through eigenvector analysis.
e. Rank alternatives based on their weighted scores.

Strengths:

a. Captures the complex relationships between criteria and incorporates decision-maker preferences.
b. Provides a structured approach for dealing with complex decision problems.
c. Enables checking for consistency in judgments.

Weaknesses:

a. Requires more effort and data compared to IMPI.
b. Relies heavily on subjective judgments, potentially introducing bias.
c. Complex calculations and algorithms may be intimidating for some users.

Table 3.13: Summarizing the Key Differences.

Feature	IMPI	AHP
Data needs	Minimal	More data required (pairwise comparisons)
accurate	more accurate	Less accurate
Calculations	Simple	Complex (eigenvector analysis)
operate	Easy to use, identifies key drivers	difficult to use, structured approach
effort	Less effort	More effort

To make the optimal choice, it is advisable to assess your particular decision scenario about the merits and drawbacks of each approach. IMPI is considered the optimal approach, contingent upon the aforementioned parameters.

3.8 SUMMARY

This chapter provides an overview of the approach employed in the present study. This section provides a comprehensive analysis of the questionnaire development process, along with a detailed examination of the (AHP) and the subsequent survey implementation. The data analysis techniques employed in this study encompassed descriptive analysis, factor analysis by (IMPI) and priority comparisons. These methods were utilized to determine factor weights and assess the rationale underlying the assigned weights.

4. RESULT AND DISCUSSION

4.1 INTRODUCTION

The purpose of this study is to the academic requirements for the field of civil engineering and project management. The precision and impartiality exhibited in your response demonstrate a strong sense of conviction.

4.2 GENERAL INFORMATION

The acquisition of general information is essential for responders to possess before obtaining master information.

4.2.1 Scientific Degree

Table 4.1: Academic Degree.

Academic Degree	Responses	Percentage
B.Sc.	58	22.31%
High Diploma	42	16.15%
M.Sc.	79	30.38%
PhD.	81	31.15%

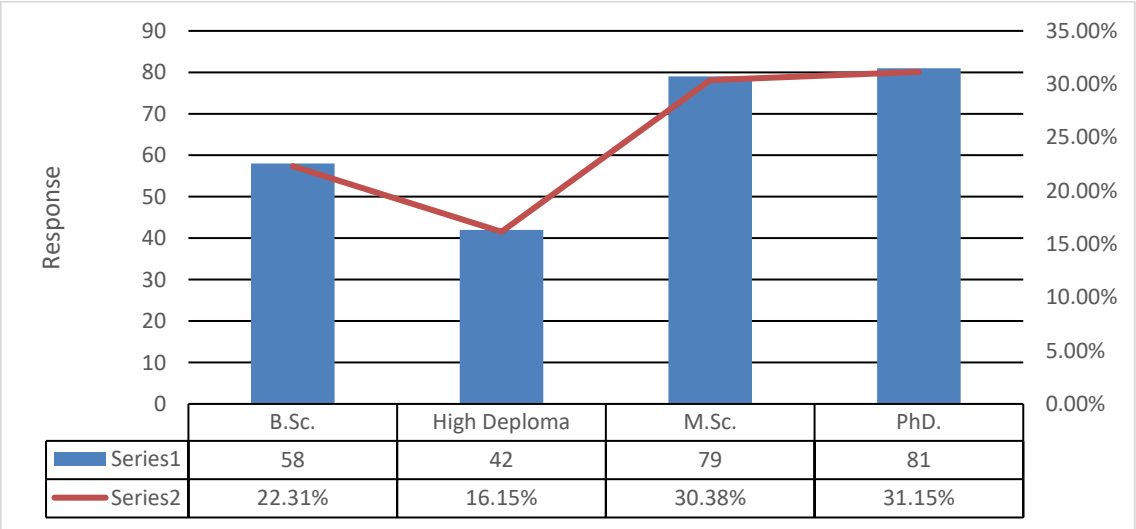

Figure 4.1: Academic Degree Chart.

The chart shows the percentage of people with a scientific degree in various engineering fields. The data is sorted from left to right, with the lowest percentage of people with a scientific degree in a field on the left and the highest percentage on the right. Here is a

breakdown of the data, sorted from lowest to highest percentage of people with a scientific degree:

a. High Diploma: 16.15%

b. B.Sc.: 22.31%

c. M.Sc.: 30.38%

d. PhD.: 31.15%

As you can see, the percentage of people with a PhD in engineering is the highest, followed by the percentage of people with a master's degree in engineering. The percentage of people with a Bachelor's degree in engineering is lower than the percentage of people with a Master's degree or PhD, and the percentage of people with a High Diploma in engineering is the lowest..

4.2.2 Specialization

Most of the responses of the engineering in their specialization answers the question are, Site Engineer 84, Office Engineer 50, Advisor 26, Project Manager 42, Contractor 58.

Table 4.2: Specialization Responses.

specialization	Responses	Percentage
Site Engineer	84	32.31%
Office Engineer	50	19.23%
Advisor	26	10.00%
Project Manager	42	16.15%
Contractor	58	22.31%

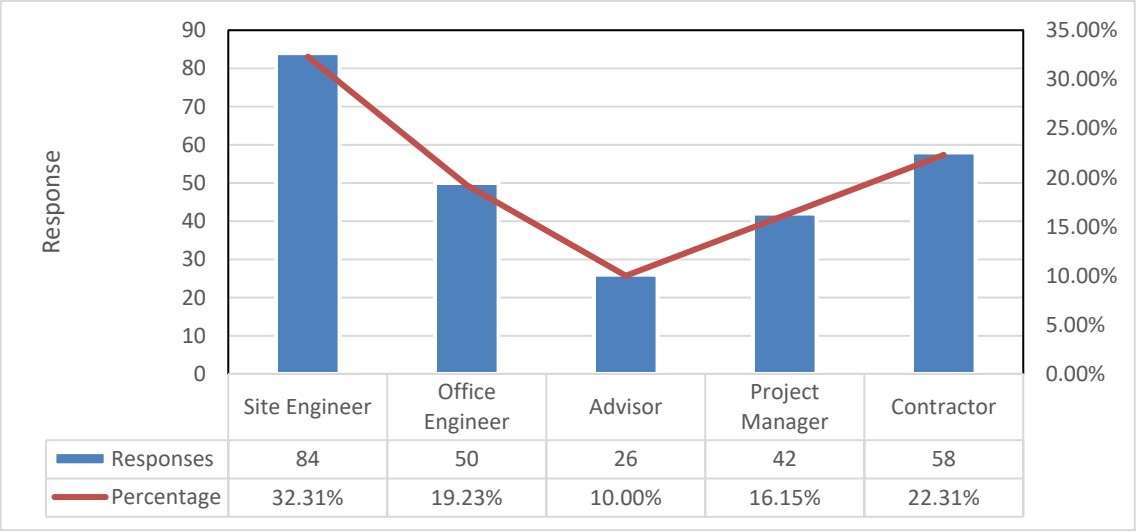

Figure 4.2: Specialization Responses Chart.

The chart shows the percentage of respondents to a survey who specialize in different engineering fields. The X-axis shows the percentage of responses, and the Y-axis shows the engineering field. The data is sorted from highest to lowest percentage of respondents.

Here is a breakdown of the data, sorted from highest to lowest percentage of respondents:

a. Site engineer: 32.31%

b. Contractor: 22.31%

c. Office engineer: 19.23%

d. Project manager: 16.15%

e. Advisor: 10.00%

As you can see, the most common specialization among the respondents is Site Engineer, followed by Project Manager and Contractor. The least common specializations are Advisor and Office Engineer. Overall, the chart provides a snapshot of the specializations of engineers who responded to the survey. It is important to note that this is just a small sample of engineers, and the results may not be representative of all engineers.

4.2.3 Type of Business Sector

Table 4.3: Responses Sector.

Type	Responses	Percentage
General	131	50.38%
Mix Sector (Both)	72	27.69%
Private	57	21.92%

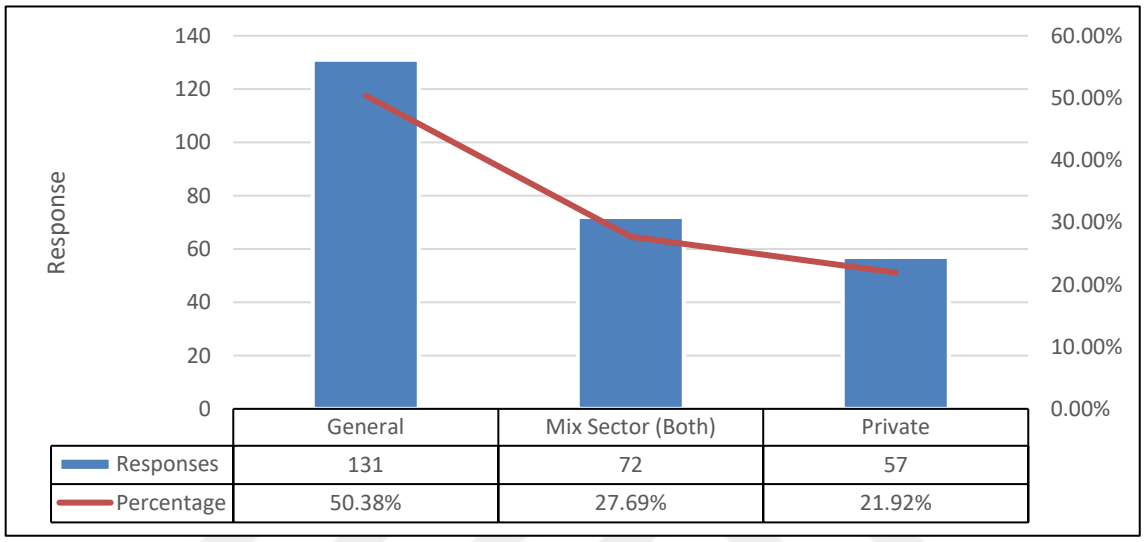

Figure 4.3: Responses Sector Chart.

The chart shows the percentage of respondents to a survey who work in different types of business sectors in the engineering field. The X-axis shows the percentage of responses, and the Y-axis shows the type of business sector. The data is sorted from highest to lowest percentage of respondents. Here is a breakdown of the data, sorted from highest to lowest percentage of respondents:

a. General: 50.38%

b. Mix sector: 27.69%

c. Private: 21.92%

As you can see, the most common type of business sector that the respondents work in is General, followed by Mix sector and Private.

4.2.4 Business Expert

Table 4.4: Responses Expert.

EXPERT	Responses	Percentage
Under 5 Years	54	20.77%
5-10 Years	65	25.00%
10-15 Years	69	26.54%
More than 15 Years	72	27.69%

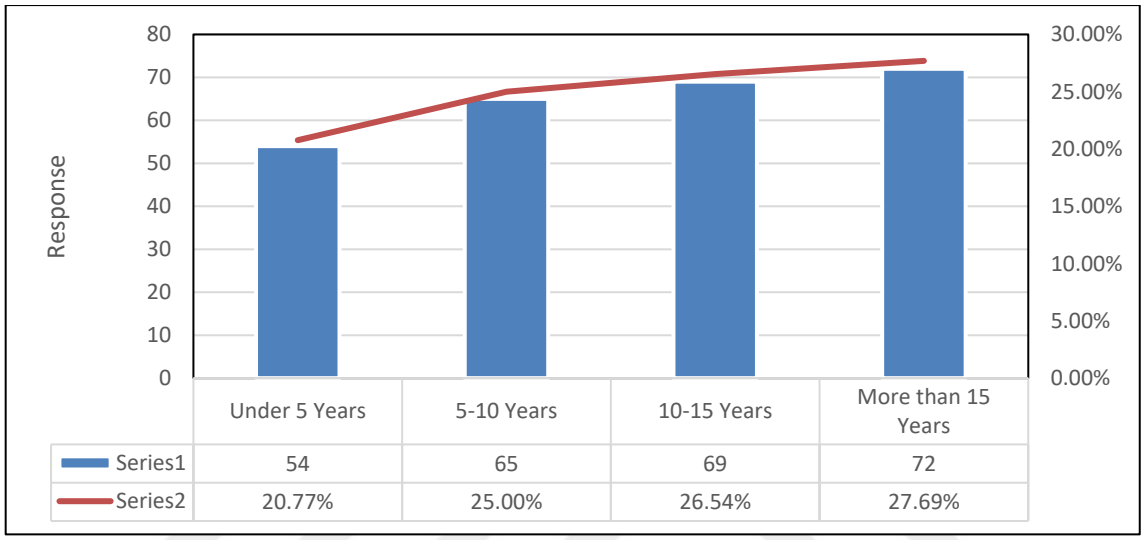

Figure 4.4: Responses Expert Chart.

a. under 5 years: 20.77%

b. 5-10 years: 25%

c. 10-15 years : 26.54%

d. More than 15 years :27.69%

As you can see, the most common type of expert they more than 15 years .

4.3 SPECIAL QUESTION

The questionnaire utilizes the Five Levels mentioned.

4.3.1 Importance of Building Project Delays

a. Contract duration that is too long.

Table 4.5: Too Long Contract.

Importance	Responses	Percentage
Significantly Less Important	44	16.92%
Less Important	76	29.23%
Important	58	22.31%
More Important	43	16.54%
Significantly More Important	39	15.00%

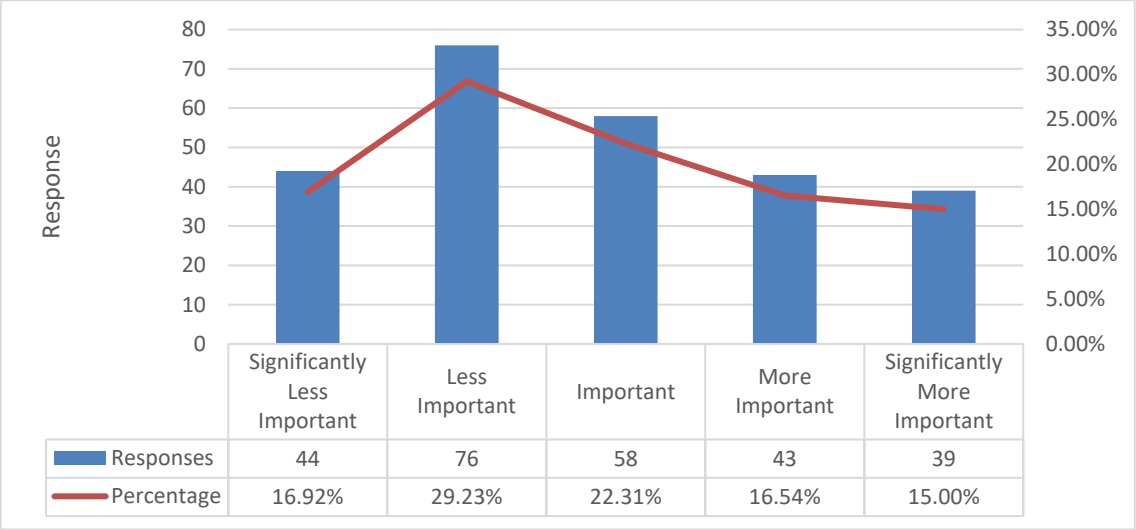

Figure 4.5: Too Long Contract.

The chart shows the results of a survey that asked respondents to rate the importance of the statement "Too Long Contract" in the engineering fields on a 5-point Likert scale, where 1 is "Significantly Less Important" and 5 is "Significantly More Important." The chart shows the number of responses for each rating, as well as the percentage of respondents who chose each rating. Here is the data sorted by percentage, from least important to most important:

a. Significantly Less Important: 16.92% (44 responses)

b. Less Important: 29.23% (76 responses)

c. Important: 22.31% (58 responses)

d. More Important: 16.54% (43 responses)

e. Significantly More Important: 15% (39 responses)

Overall, the chart suggests that the majority of respondents believe that the length of contracts is an important factor to consider in the engineering field. However, there is also a significant minority of respondents who believe that it is not a very important factor.

b. The project's scope is not well defined.

Table 4.6: Project's Scope is Unclear.

Importance	Responses	Percentage
Significantly Less Important	33	12.69%
Less Important	45	17.31%
Important	84	32.31%
More Important	54	20.77%
Significantly More Important	44	16.92%

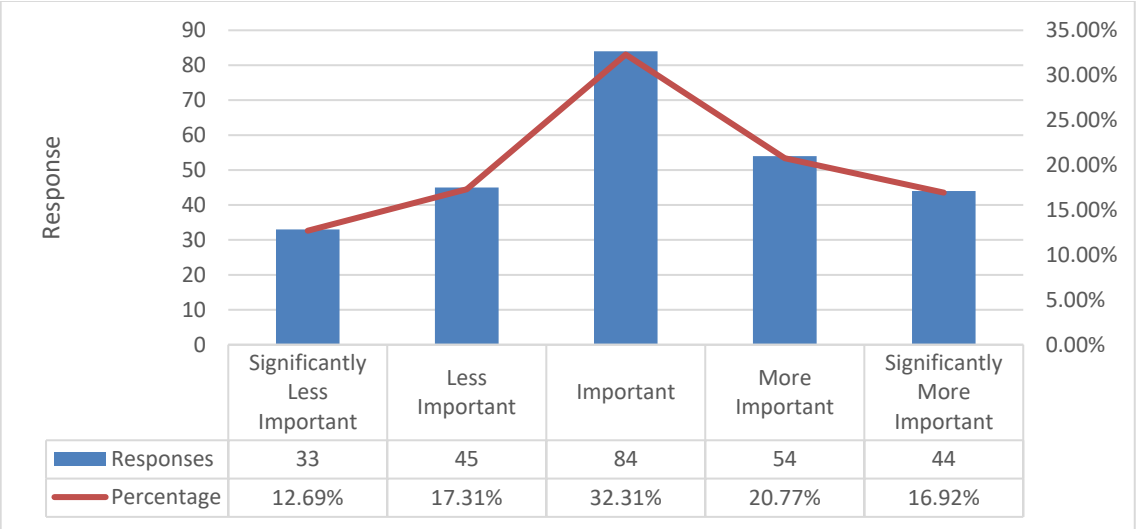

Figure 4.6: Project's Scope Is Unclear Chart.

The Likert scale is a commonly used method for measuring ordinal data, such as degrees of agreement or importance. In this case, the scale would range from 1 (Strongly Disagree) to 5 (Strongly Agree) with the statement "The project's scope is unclear."

As you can see, the most important category is "More Important," which includes 32.31% of the responses. This suggests that a significant portion of the respondents believe that the project's scope is unclear. The next most important category is More Important," which includes 20.77% of the responses. This suggests that a smaller, but still significant, portion of the respondents believe that the project's scope is very unclear.

The least important categories are "Significantly Less Important" and "Less Important," which together include only 30% of the responses. This suggests that a minority of the respondents believe that the project's scope is clear.

Overall, the data suggests that the project's scope is unclear for a significant portion of the respondents. This could be a problem, as it can lead to misunderstandings, delays, and cost

overruns. The project manager needs to take steps to clarify the scope of the project as soon as possible.

Despite these limitations, the data in the chart provides some valuable insights into the respondents' perceptions of the project's scope. It is important to take these insights into account when making decisions about the project.

c. Poor administration of contracts.

Table 4.7: Poor Administration.

Importance	Responses	Percentage
Significantly Less Important	41	15.77%
Less Important	39	15.00%
Important	96	36.92%
More Important	36	13.85%
Significantly More Important	48	18.46%

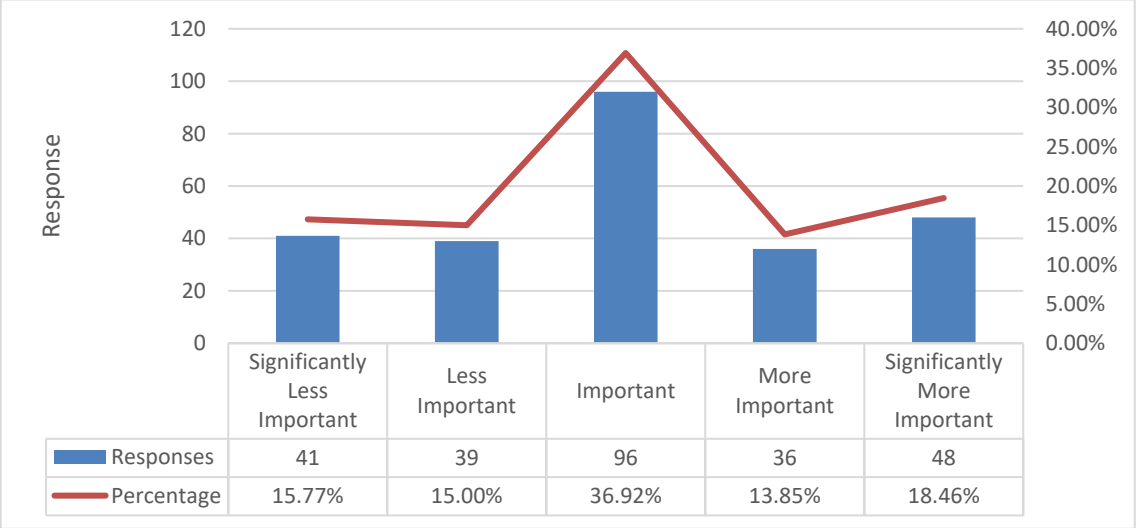

Figure 4.7: Poor Administration Chart.

The data in the chart can be sorted in a few different ways, depending on what you want to see. Here are a few options:

Based on the limited information I have about the chart, it is difficult to say definitively which factors are most important to respondents. However, it does appear that the factor of "poor administration" is rated as "Important" or higher by the most respondents (36.92%).

It is important to note that this is just one survey, and the results may not be representative of the views of all stakeholders. However, it does provide some insights into the factors that

are important to some decision-makers when it comes to prioritizing Research and development (R&D) projects.

d. Inadequate project planning in the beginning

Table 4.8: Poor Planning for the Project at the Start.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	39	15.00%
Important	59	22.69%
More Important	99	38.08%
Significantly More Important	39	15.00%

The data in the chart can be sorted in a few different ways, depending on what you want to see. Here are a few options. Based on the data in the chart, here is the sorted list of factors in terms of the percentage of respondents who rated them as "Important" or higher:

a. Significantly More Important: 15.00%

b. More Important: 38.08%

c. Important: 22.69%

d. Less Important:15.00%

e. Significantly Less Important: 9.23%

As you can see, the majority of respondents believe that "poor project planning in the beginning" is an important or very important factor in engineering projects. The most important factor, according to the survey, is " More Important" 38.08%.

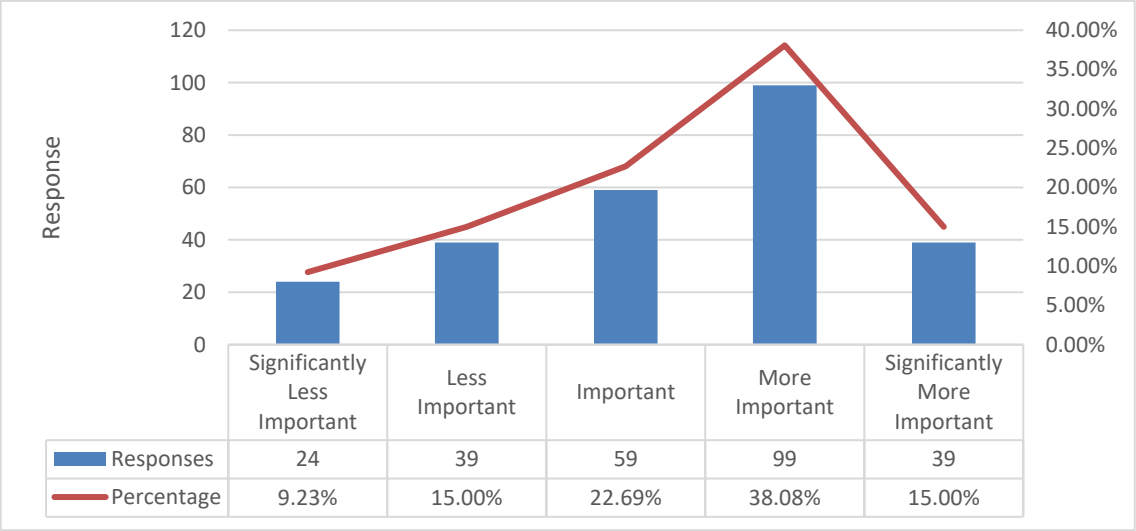

Figure 4.8: Poor Planning for the Project at the Start Chart.

e. Improperly early project schedule

Table 4.9: A Premature Project Timeline.

Importance	Responses	Percentage
Significantly Less Important	23	8.85%
Less Important	61	23.46%
Important	80	30.77%
More Important	37	14.23%
Significantly More Important	59	22.69%

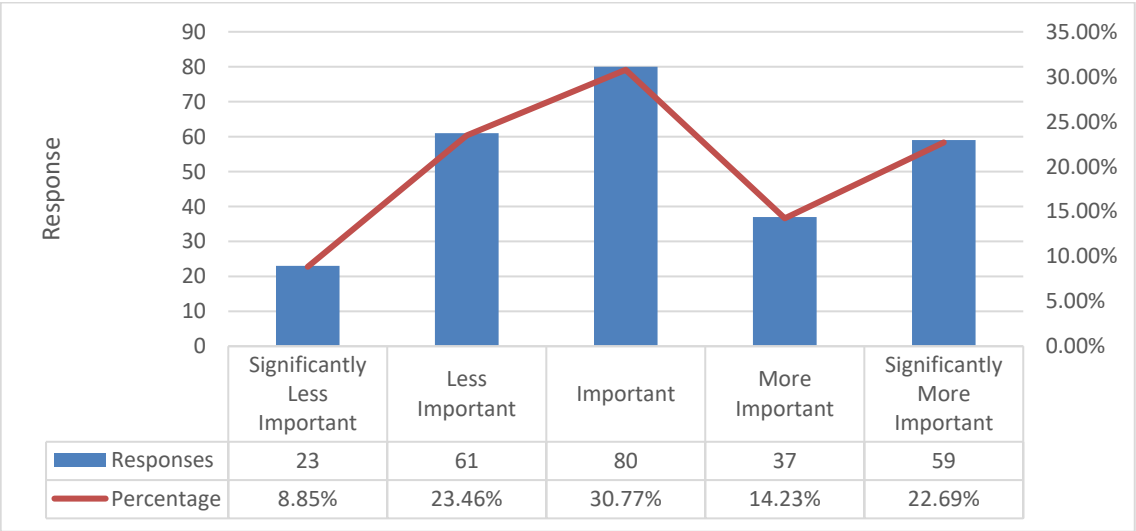

Figure 4.9: A Premature Project Timeline Chart.

The data shows that the majority of respondents view "Improperly early project schedule" as an important or very important factor in engineering projects. This is further emphasized by the fact that 30.77% of respondents rated this factor as "Important"

a. Significantly Less Important 8.85%

b. Less Important 23.46%

c. Important 30.77%

d. More Important 14.23%

e. Significantly More Important 22.69%

f. Owner's late approval of design documentation

Table 4.10: Late Approval.

Importance	Responses	Percentage
Significantly Less Important	33	12.69%
Less Important	47	18.08%
Important	70	26.92%
More Important	85	32.69%
Significantly More Important	25	9.62%

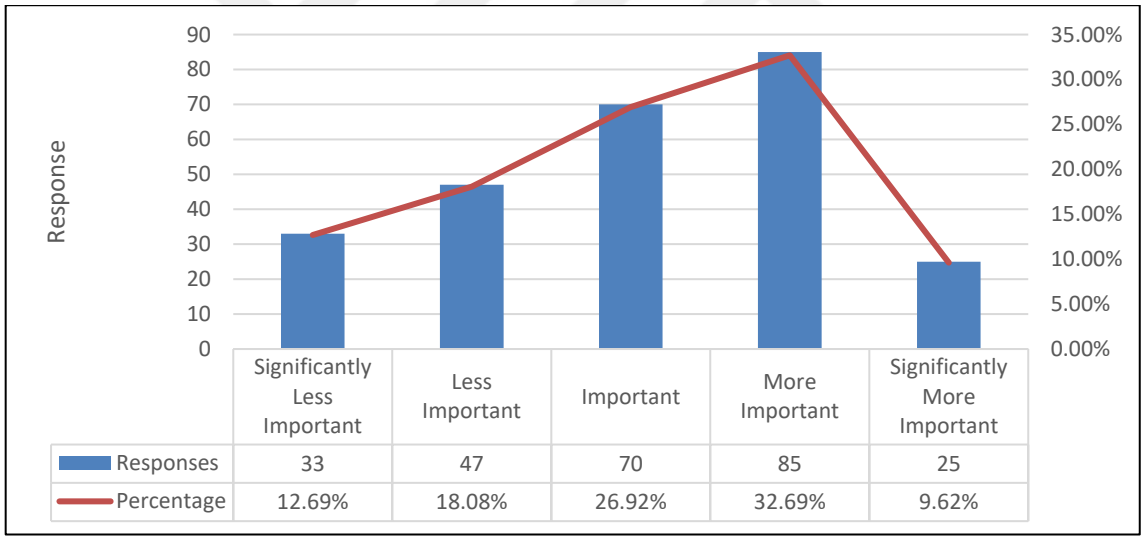

Figure 4.10: Late Approval Chart.

Here's a breakdown of the data:

a. Significantly less important (1): 12.69% of respondents selected this option.

b. Less important (2): 18.08% of respondents selected this option.

c. Important (3): 26.92% of respondents selected this option.

d. More important (4): 32.69% of respondents selected this option.

e. Significantly more important (5): 9.62% of respondents selected this option.

Overall, the data suggests that **most respondents consider "Improperly early project schedule" to be an important or very important factor in engineering projects. This is because the combined percentage of respondents who selected "Important", "More important", and "Significantly more important". Ultimately, the importance of "Improperly early project schedule" as a factor in engineering projects will likely depend on the specific context of each project. However, the data from this survey suggests that it is a significant concern for many engineers.

g. Work is put on hold.

Table 4.11: Work Paused.

Importance	Responses	Percentage
Significantly Less Important	36	13.85%
Less Important	15	5.77%
Important	60	23.08%
More Important	135	51.92%
Significantly More Important	14	5.38%

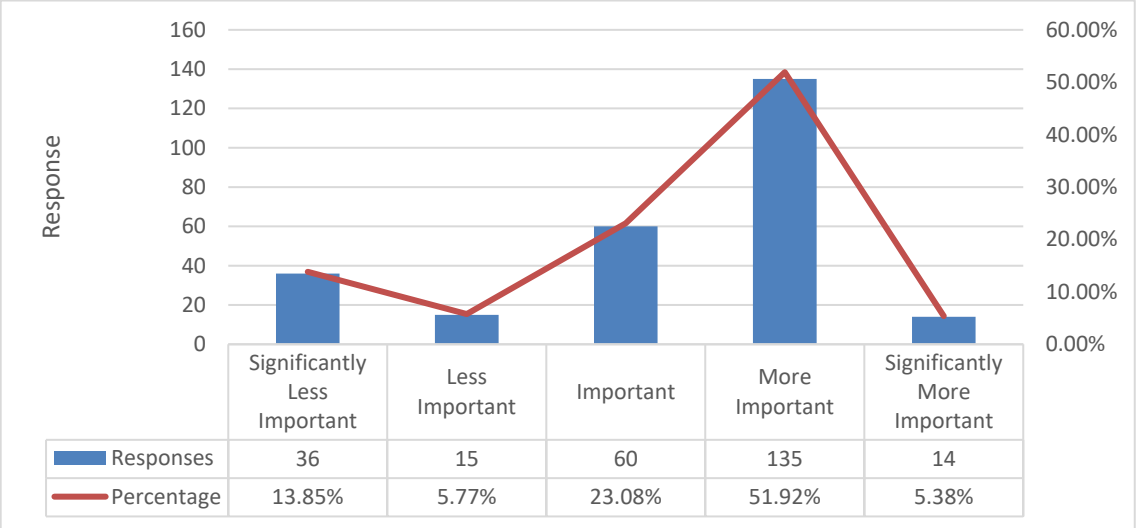

Figure 4.11: Work Paused Chart.

As you can see, the majority of respondents (51.92%) said that work is put on hold " More Important" in the engineering fields. This is followed by "significantly More Important" (5.38%), " Important" (23.08%), "Less Important" (5.77%), and "Significantly Less Important" (13.85%).

Overall, the chart shows that a large majority of engineers believe that work is put on hold in their field. This could be due to a number of factors, such as the COVID-19 pandemic, which has caused many engineering projects to be delayed or cancelled. It could also be due to the nature of engineering work, which often requires careful planning and execution, and can be easily disrupted by unforeseen circumstances.

h. Owner's delay in making progress payments.

Table 4.12: Owner's Late Progress Payments.

Importance	Responses	Percentage
Significantly Less Important	36	13.85%
Less Important	37	14.23%
Important	102	39.23%
More Important	46	17.69%
Significantly More Important	39	15.00%

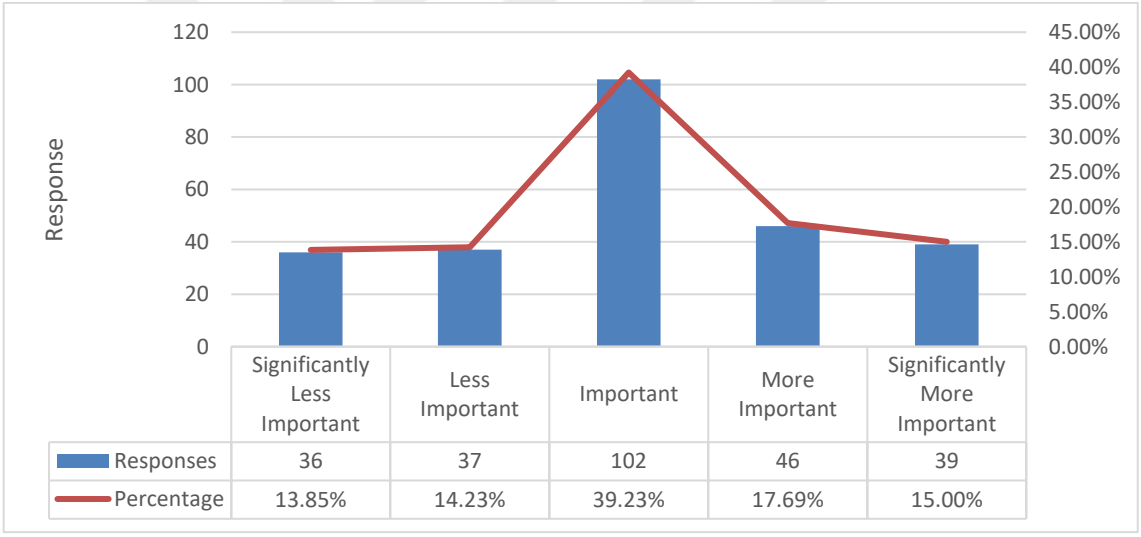

Figure 4.12: Owner's Late Progress Payments.

As you can see, the largest group of respondents (39.23%) selected the Important option, indicating that owner's delay in making progress payments is neither particularly important nor unimportant in their experience. The next largest group (28.08%) selected either "Less Important" and "Significantly Less Important," suggesting that these respondents view payment delays as a relatively minor concern. Conversely, 17.69% and 15.00% of respondents selected "More Important" or "Significantly More Important," respectively, indicating that they consider payment delays to be a significant or even critical issue.

i. Owner and other parties' poor communication

Table 4.13: Poor Communication by Owners and Others.

Importance	Responses	Percentage
Significantly Less Important	28	10.77%
Less Important	69	26.54%
Important	66	25.38%
More Important	71	27.31%
Significantly More Important	26	10.00%

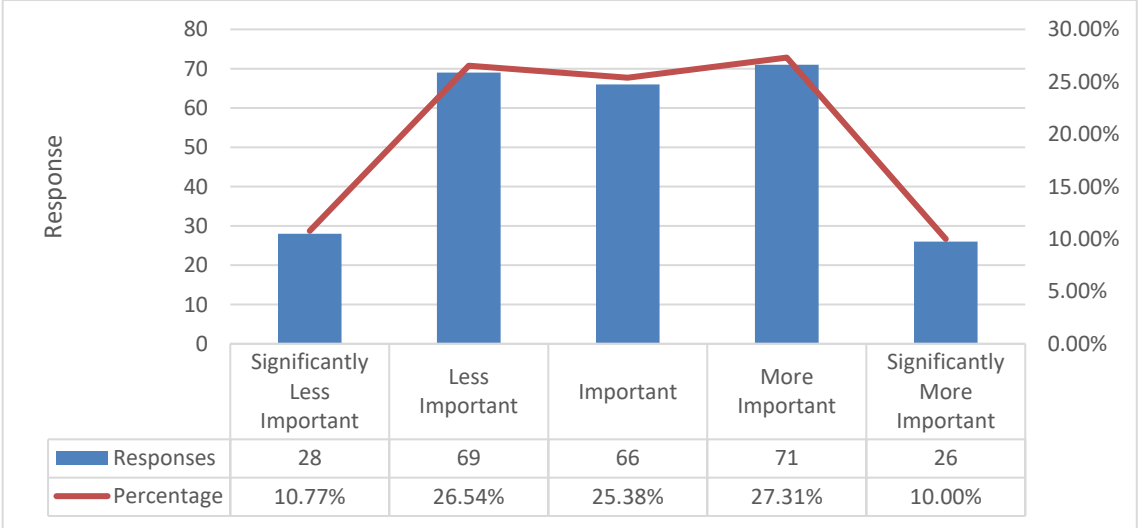

Figure 4.13: Poor Communication by Owners and Others.

The chart shows that the majority of respondents (27.31%) believe that owner and other parties' poor communication is "more important." 26.54% of respondents believe that it is "less important," and 10.77% believe that it is "significantly more important." A smaller percentage of respondents (10.00%) believe that it is "not at all important" or "slightly important."

As you can see, the majority of respondents believe that owner and other parties' poor communication is at least somewhat important in the engineering fields. This suggests that communication between owners and other parties is an important issue that needs to be addressed.

There are a few possible explanations for why communication between owners and other parties may be poor in the engineering fields. One possibility is that owners and other parties have different priorities. Owners may be more focused on the bottom line, while engineers may be more focused on quality and safety. This can lead to misunderstandings and conflict.

Another possibility is that owners and other parties simply don't communicate effectively with each other. They may not use clear and concise language, or they may not listen to each other carefully. This can also lead to misunderstandings and conflict.

Whatever the reason, it is clear that poor communication between owners and other parties can have a negative impact on engineering projects. It can lead to delays, cost overruns, and even safety hazards. Therefore, it is important to find ways to improve communication between these two groups.

j. Poorly managed site

Table 4.14: Badly Handled Site.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	64	24.62%
Important	77	29.62%
More Important	89	34.23%
Significantly More Important	6	2.31%

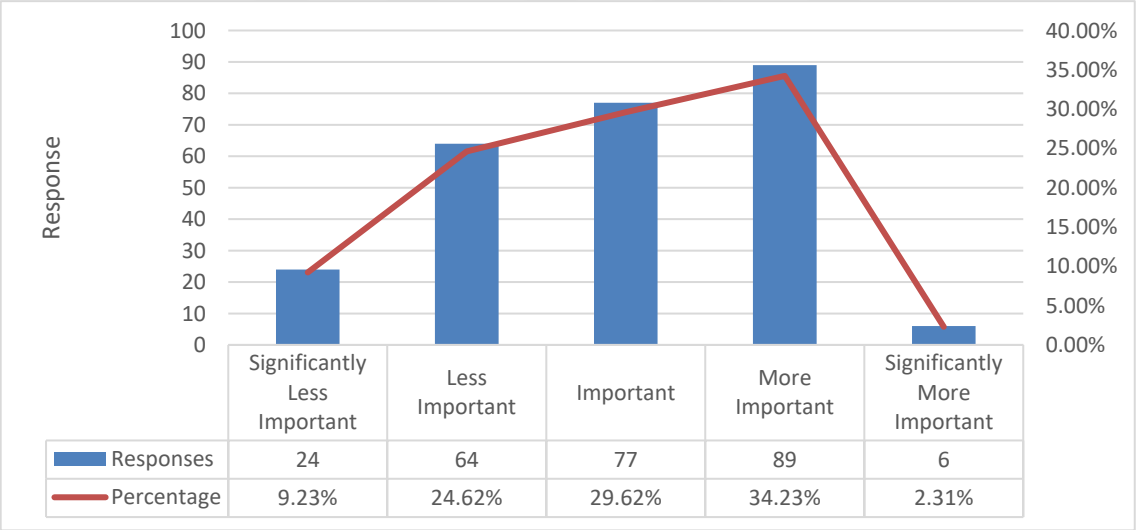

Figure 4.14: Badly Handled Site.

a. Significantly Less Important: 9.23% of respondents rated having a well-managed construction site as "Significantly Less Important."

b. Less Important: 24.62% of respondents rated having a well-managed construction site as "Less Important."

c. Important: 29.62% of respondents rated having a well-managed construction site as " Important."

d. More Important: 34.23% of respondents rated having a well-managed construction site as "More Important."

e. Significantly More Important: 2.31% of respondents rated having a well-managed construction site as "Significantly More Important."

k. Staff from the contractor assigned to the project was poorly qualified.

Table 4.15: Stuff of Project was Poorly Qualified.

Importance	Responses	Percentage
Significantly Less Important	43	16.54%
Less Important	54	20.77%
Important	51	19.62%
More Important	95	36.54%
Significantly More Important	17	6.54%

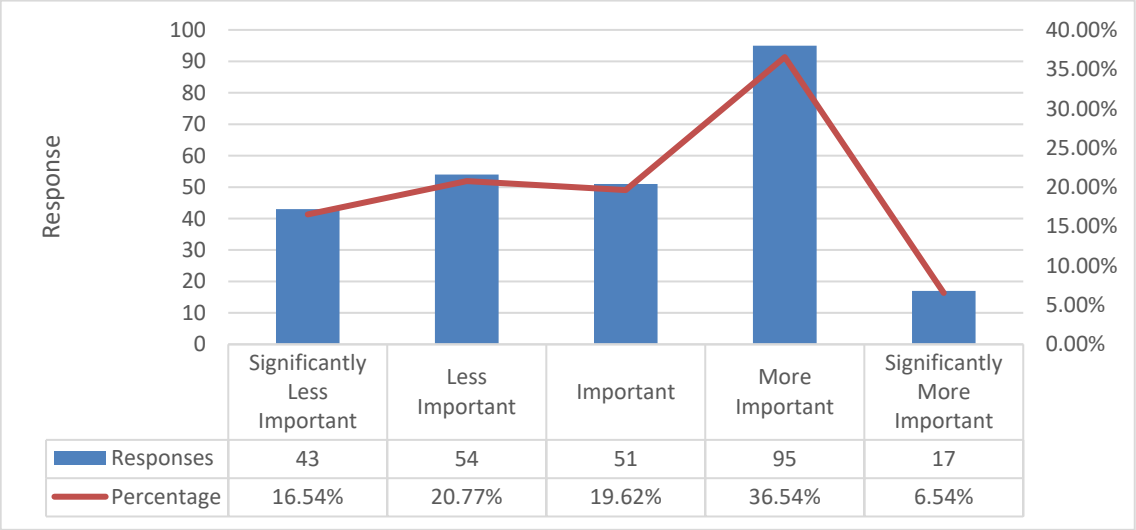

Figure 4.15: Stuff of Project was Poorly Qualified.

a. Significantly Less Important: 16.54% of respondents rated having qualified contractor staff assigned to the project as "Significantly Less Important."

b. Less Important: 20.77% of respondents rated having qualified contractor staff assigned to the project as "Less Important."

c. Important: 19.62% of respondents rated having qualified contractor staff assigned to the project as " Important."

d. More Important: 36.54% of respondents rated having qualified contractor staff assigned to the project as “More Important.”

e. Significantly More Important: 6.54% of respondents rated having qualified contractor staff assigned to the project as “Significantly More Important.”

l. Lack of resources

Table 4.16: Lack of Resources.

Importance	Responses	Percentage
Significantly Less Important	59	22.69%
Less Important	26	10.00%
Important	54	20.77%
More Important	71	27.31%
Significantly More Important	50	19.23%

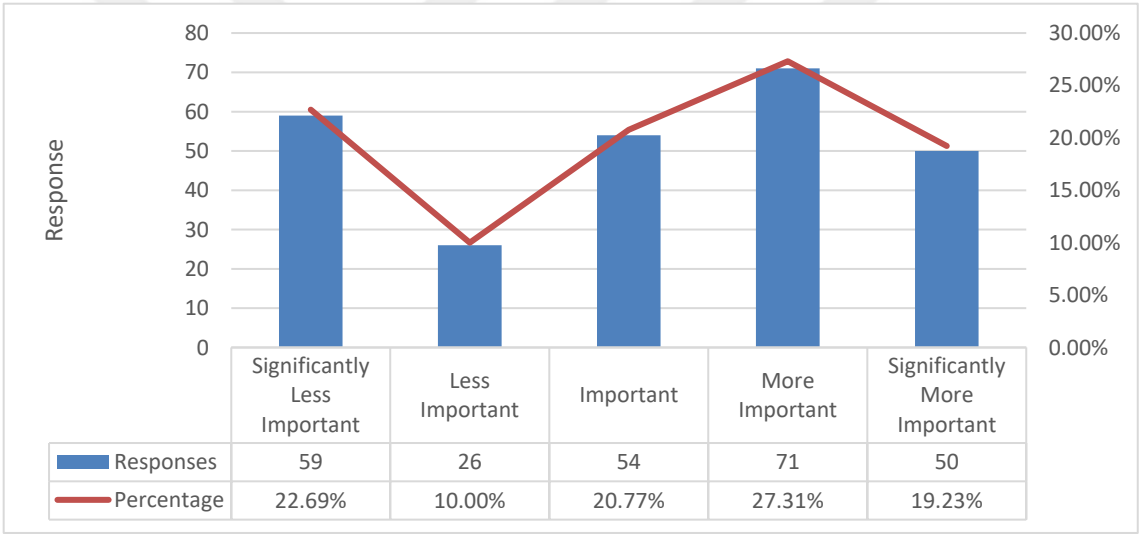

Figure 4.16: Lack of Resources.

a. Significantly Less Important (1): 22.69% of respondents reported that they strongly disagree that there is a lack of resources in their engineering field. This suggests that a significant minority of engineers believe that their fields are well-resourced.

b. Less Important (2): 10.00% of respondents reported that they disagree that there is a lack of resources in their engineering field. This suggests that a smaller group of engineers believe that their fields are adequately resourced.

c. Important (3): 20.77% of respondents reported that they are Important on the statement. This suggests that these engineers are unsure whether or not there is a lack of resources in their field.

d. More Important (4): 27.31% of respondents reported that they agree that there is a lack of resources in their engineering field. This suggests that a plurality of engineers believe that their fields are under-resourced.

e. Significantly More Important (5): 19.23% of respondents reported that they strongly agree that there is a lack of resources in their engineering field. This suggests that a significant minority of engineers believe that their fields are severely under-resourced.

Overall, the chart suggests that there is a perceived lack of resources in many engineering fields. However, there is also a significant minority of engineers who believe that their fields are well-resourced. It is important to note that this chart is based on self-reported data, and there may be some bias in the responses.

m. Equipment delivery is delayed.

Table 4.17: Delays in Equipment Delivery.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	97	37.31%
Important	25	9.62%
More Important	36	13.85%
Significantly More Important	78	30.00%

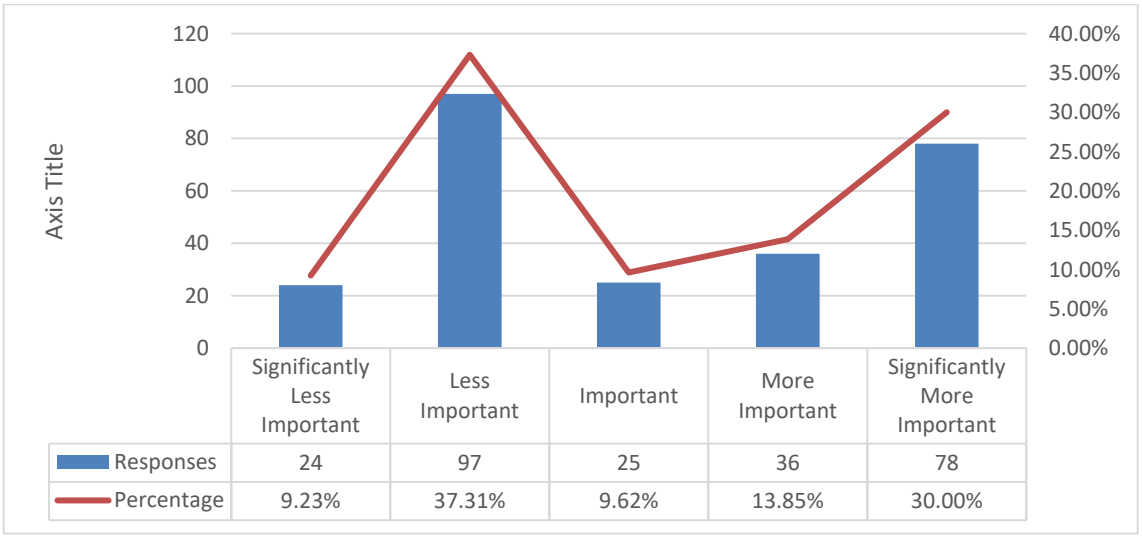

Figure 4.17: Delays in Equipment Delivery.

a. Significantly Less Important (1): 9.23% of respondents reported that they strongly disagree that equipment delivery is delayed in their engineering field. This suggests that a small minority of engineers believe that equipment delivery is always on time.

b. Less Important (2): 37.31% of respondents reported that they disagree that equipment delivery is delayed in their engineering field. This suggests that a small group of engineers believe that equipment delivery is rarely delayed.

c. Important (3): 9.62% of respondents reported that they are Important on the statement. This suggests that these engineers are unsure whether or not equipment delivery is delayed in their field.

d. More Important (4): 13.85% of respondents reported that they agree that equipment delivery is delayed in their engineering field. This suggests that a plurality of engineers believe that equipment delivery is sometimes delayed.

e. Significantly More Important (5): 30% of respondents reported that they strongly agree that equipment delivery is delayed in their engineering field. This suggests that a significant minority of engineers believe that equipment delivery is frequently or always delayed.

n. Delay in acquiring municipal permits.

Table 4.18: Municipal Permission Delays.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	27	10.38%
Important	89	34.23%
More Important	35	13.46%
Significantly More Important	85	32.69%

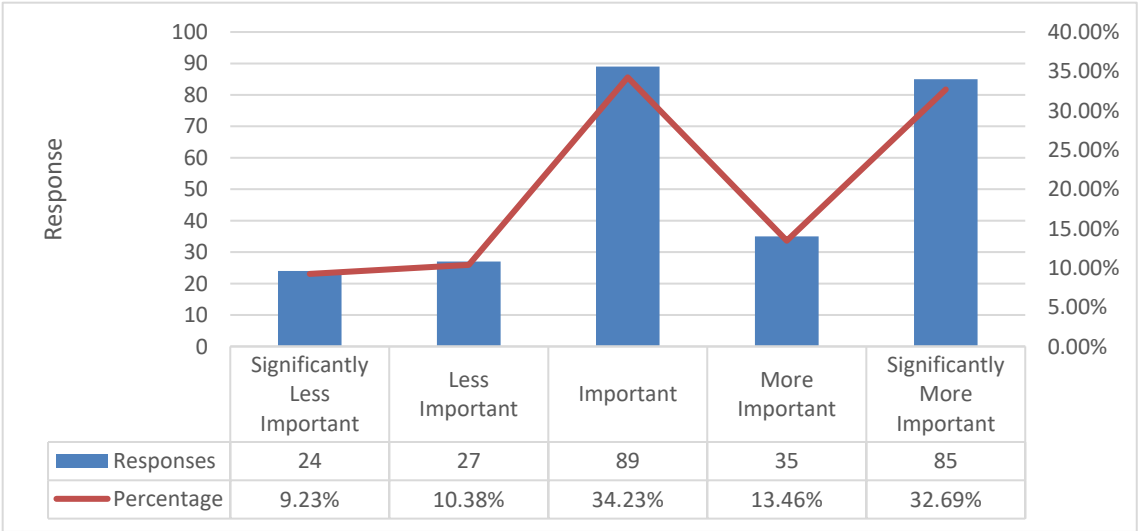

Figure 4.18: Municipal Permission Delays.

a. Significantly Less Important (1): 9.23% of respondents reported that they strongly disagree that there is a delay in acquiring municipal permits in their engineering field. This suggests that a small minority of engineers believe that the permitting process is always efficient.

b. Less Important (2): 10.38% of respondents reported that they disagree that there is a delay in acquiring municipal permits in their engineering field. This suggests that a small group of engineers believe that the permitting process is rarely delayed.

c. Important (3): 34.23% of respondents reported that they are Important on the statement. This suggests that these engineers are unsure whether or not the permitting process is delayed in their field.

d. More Important (4): 13.46% of respondents reported that they agree that there is a delay in acquiring municipal permits in their engineering field. This suggests that a plurality of engineers believe that the permitting process is sometimes delayed.

e. Significantly More Important (5): 32.69% of respondents reported that they strongly agree that there is a delay in acquiring municipal permits in their engineering field. This suggests that a significant minority of engineers believe that the permitting process is frequently or always delayed.

o. Result of the weather

Table 4.19: The Weather Maybe do Delays.

Importance	Responses	Percentage
Significantly Less Important	45	17.31%
Less Important	38	14.62%
Important	61	23.46%
More Important	89	34.23%
Significantly More Important	27	10.38%

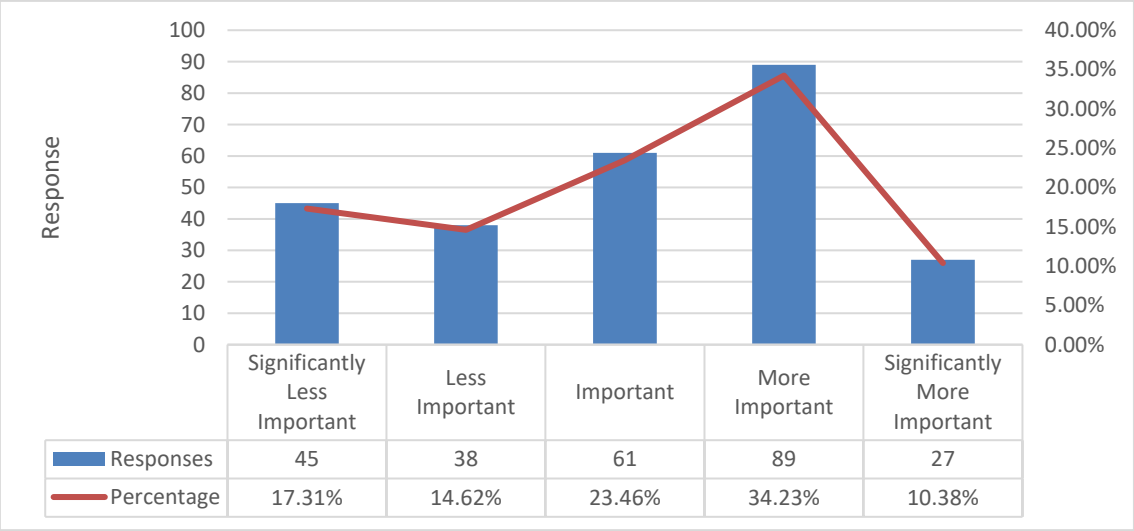

Figure 4.19: The Weather Maybe Do Delays Chart.

The most important factor, according to the survey, is " More Important" 34.23%.

p. Project traffic management

Table 4.20: Manage Project Traffic.

Importance	Responses	Percentage
Significantly Less Important	60	23.08%
Less Important	58	22.31%
Important	42	16.15%
More Important	51	19.62%
Significantly More Important	49	18.85%

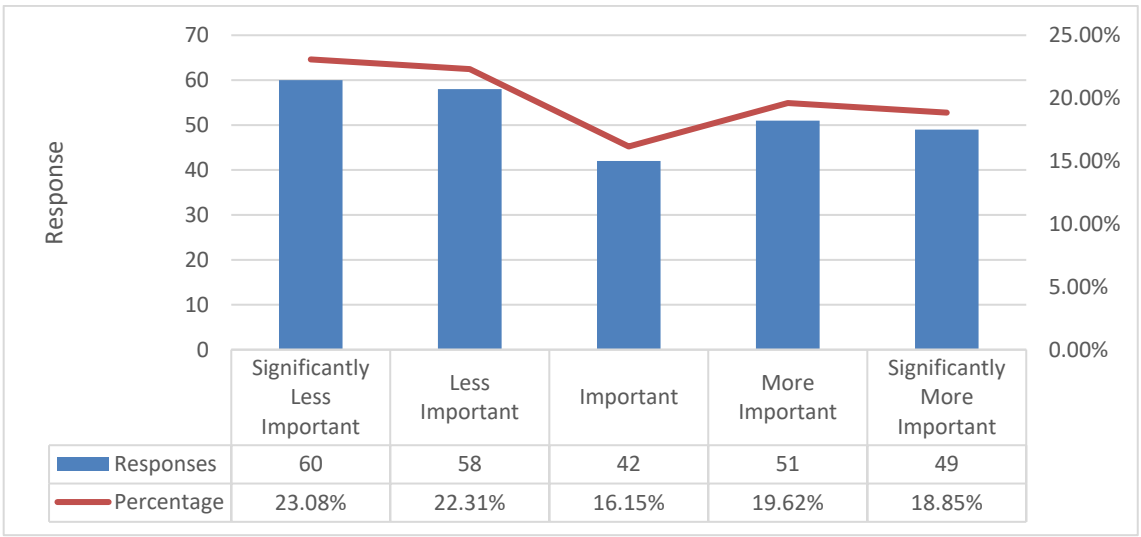

Figure 4.20: Manage Project Traffic.

As you can see, the most common response was "significant less important," which was selected by 23.08% of respondents. The next most common responses were "less Important" (22.31%) and " important" (16.15%). A smaller number of respondents selected "Very important" (19.62%) and "Significantly more important" (18.85%).

q. Uncertainty in politics

Table 4.21: Political Confusion.

Importance	Responses	Percentage
Significantly Less Important	59	22.69%
Less Important	31	11.92%
Important	54	20.77%
More Important	42	16.15%
Significantly More Important	74	28.46%

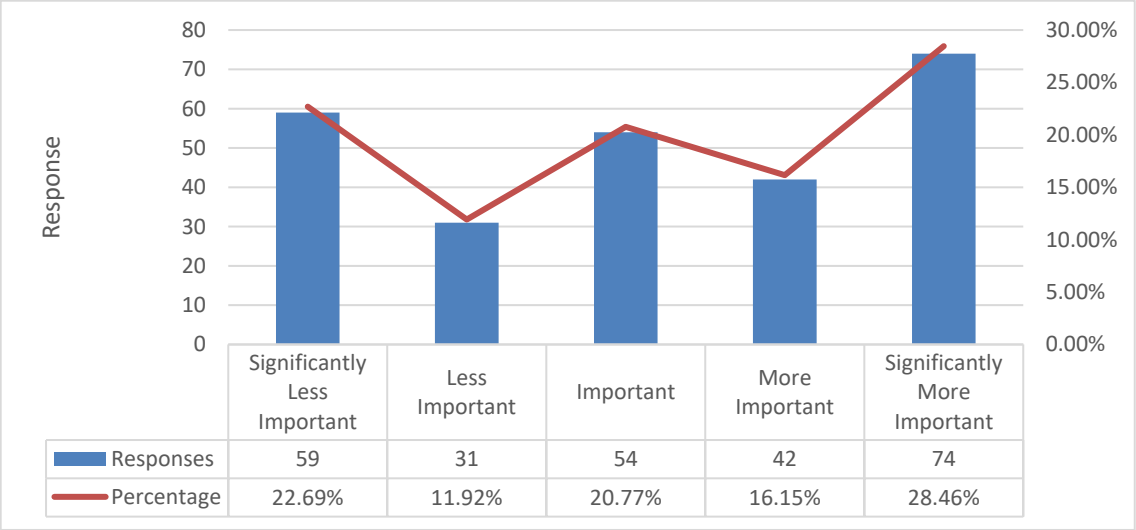

Figure 4.21: Political Confusion Chart.

Central tendency: The highest percentage of responses falls within the "significantly less Important" category (22.69%), indicating a central tendency towards perceiving uncertainty in politics as somewhat important in the engineering fields.

Distribution: The distribution of responses is relatively even across the remaining categories, with a slight skew towards the " Important" side (20.77% and 16.15% for "More Important"). This suggests that opinions are divided on the issue, with a plurality finding uncertainty in politics at least somewhat important, but a significant portion also viewing it as Important or less important.

r. Instability in the economy

Table 4.22: Economic Instability.

Importance	Responses	Percentage
Significantly Less Important	31	11.92%
Less Important	37	14.23%
Important	130	50.00%
More Important	46	17.69%
Significantly More Important	16	6.15%

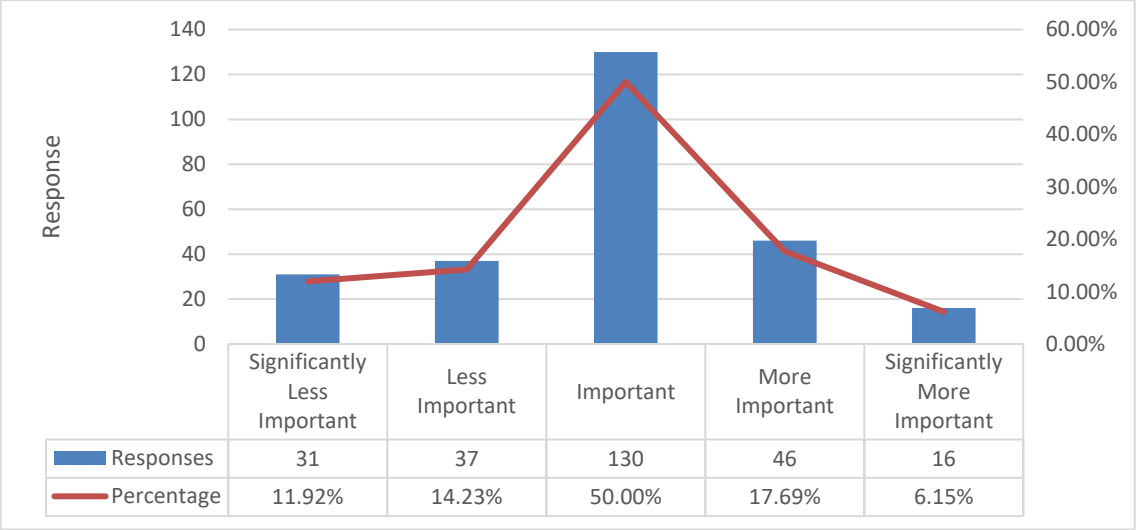

Figure 4.22: Economic Instability Chart.

The chart shows that the most common response was " Important" (50.00%), followed by " more Important" (17.69%), "Less Important" (14.23%), "significantly less Important" (11.92%), and "Significantly More Important" (6.15%).

s. Modifications to laws and regulations

Table 4.23: Modifications.

Importance	Responses	Percentage
Significantly Less Important	9	3.46%
Less Important	85	32.69%
Important	96	36.92%
More Important	41	15.77%
Significantly More Important	29	11.15%

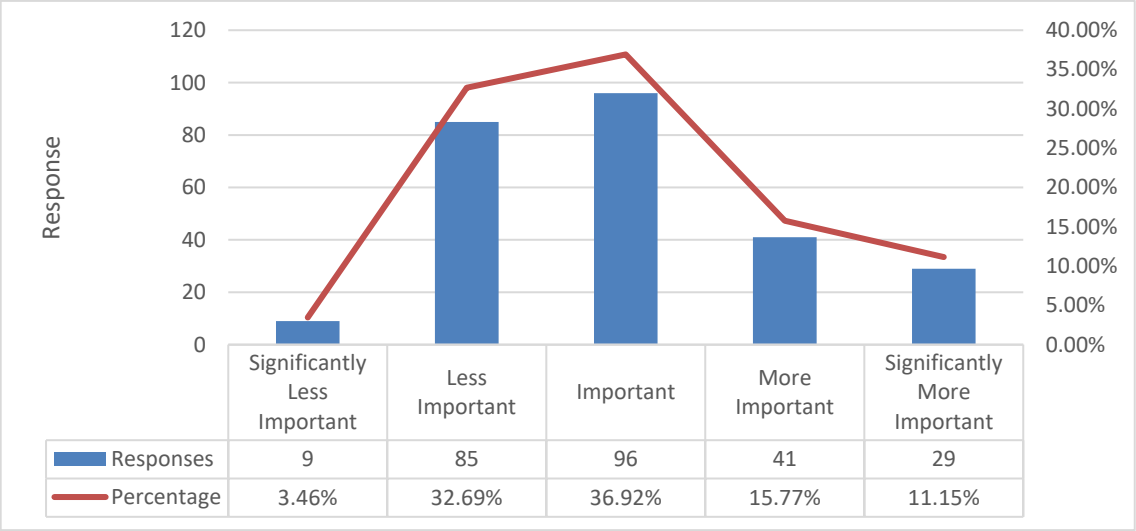

Figure 4.23: Modifications Chart.

a. Important (5): 36.92% of respondents believe that modifications to laws and regulations in the engineering fields are "Important." This suggests that a significant number of people believe that the current laws and regulations are outdated or inadequate and that significant changes are needed.

b. More Important (4): 15.77% of respondents believe that changes are "More Important." This suggests that a small number of people believe that the current laws and regulations are somewhat inadequate and that some changes are needed.

c. Significantly more Important (3): 11.15% of respondents are Important on the issue. This suggests that these respondents believe that the current laws and regulations are adequate and that no changes are needed.

d. Less Important (2): 32.69% of respondents believe that changes are "Less Important." This suggests that a large number of people believe that the current laws and regulations are mostly adequate and that only minor changes are needed.

e. Significantly Less Important (1): 3.46% of respondents believe that modifications to laws and regulations in the engineering fields are "Significantly Less Important." This suggests that a very small number of people believe that the current laws and regulations are adequate and that no changes are needed.

4.3.2 Technical Causes

a. Lack of a reliable and practical test for building materials at the customs station

Table 4.24: A Reliable and Practical Customs Station Building Material Test Is Lacking.

Importance	Responses	Percentage
Significantly Less Important	25	9.62%
Less Important	58	22.31%
Important	78	30.00%
More Important	24	9.23%
Significantly More Important	75	28.85%

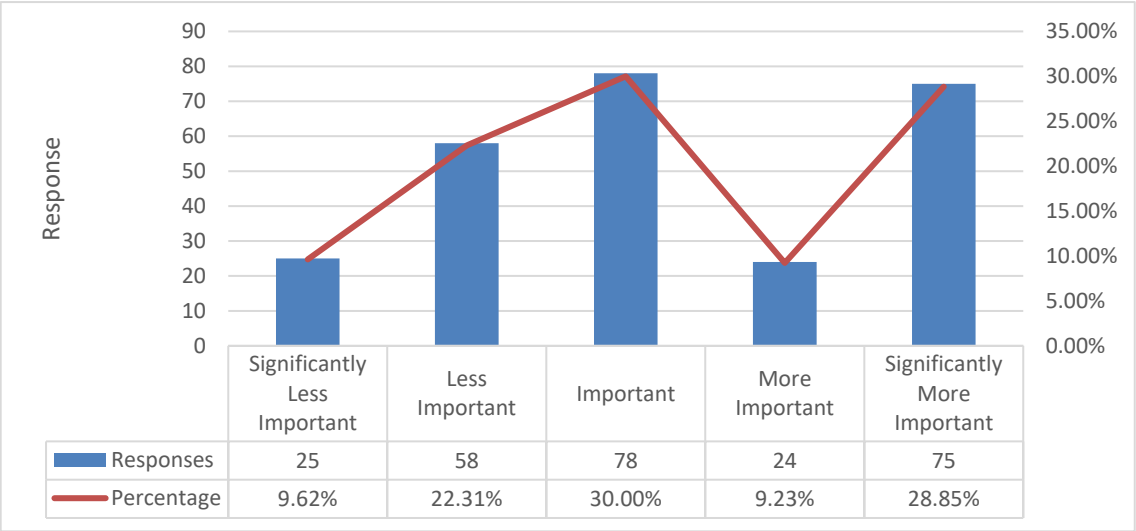

Figure 4.24: A Reliable and Practical Customs Station Building Material Test is Lacking Chart.

The data points are as follows:

a. 9.62% of respondents indicated that this is “Significantly Less Important”

b. 22.31% of respondents indicated that this is “Less Important”

c. 30.00% of respondents indicated that this is “Important”

d. 9.23% of respondents indicated that this is “Significantly Important”

e. 28.85% of respondents did not provide a response

The data suggests that a plurality of respondents (30.00%) believe that the lack of a reliable and practical test for building materials at the customs station is “Important.” However, a significant minority of respondents (22.31% + 9.62% = 31.93%) believe that it is either “Less

Important" or "Significantly Less Important." Additionally, a noteworthy portion of respondents (28.85%) did not provide a response.

b. Absence of precise code requirements for building materials at a particular location

Table 4.25: Lack of Local Building Material Code Requirements.

Importance	Responses	Percentage
Significantly Less Important	36	13.85%
Less Important	13	5.00%
Important	64	24.62%
More Important	15	5.77%
Significantly More Important	132	50.77%

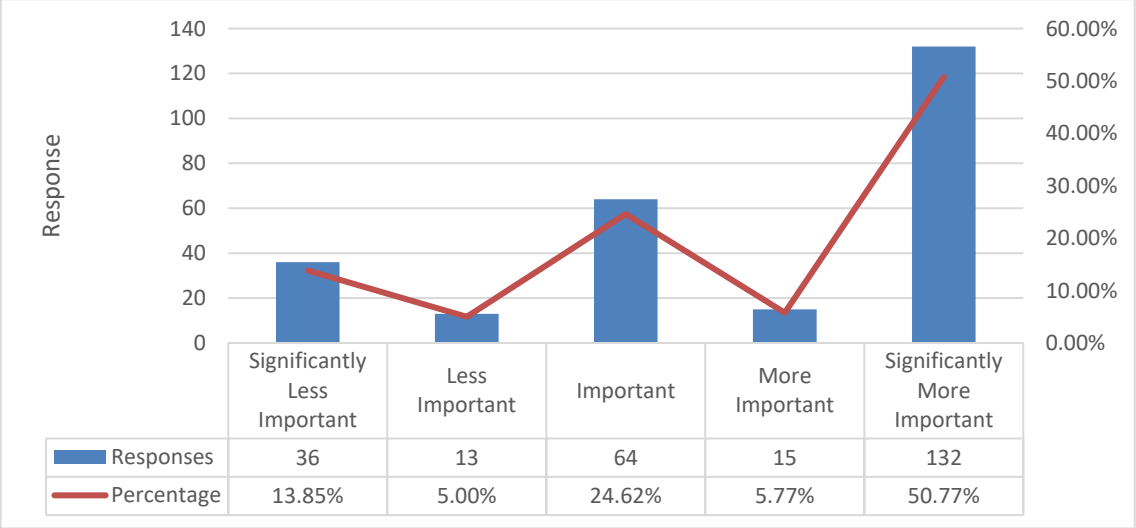

Figure 4.25: Lack of Local Building Material Code Requirements Chart.

a. 13.85% deemed the requirements "Significantly less important."

b. 5% considered them "Less important."

c. 24.62% viewed them as " important."

d. 5.77% held a position of " more important."

e. 50.77% considered them 'significantly more important'

c. The seasoned employees' lack of understanding of the provisions of the customs legislation.

Table 4.26: The Experienced Workers' Ignorance of Customs Law.

Importance	Responses	Percentage
Significantly Less Important	15	5.77%
Less Important	22	8.46%
Important	58	22.31%
More Important	89	34.23%
Significantly More Important	76	29.23%

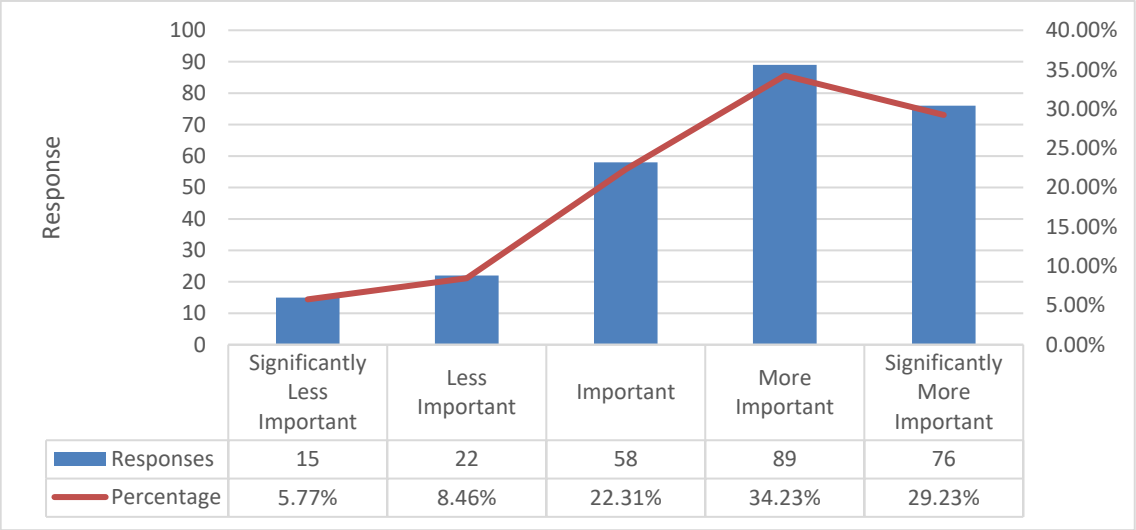

Figure 4.26: The Experienced Workers' Ignorance of Customs Law Chart.

4.3.3 Experience Causes

a. Lack of oversight regarding the market's low-quality, inexpensive materials

Table 4.27: Poor Control of The Market for Cheap, Low-Quality Materials.

	Responses	Percentage
Significantly Less Important	53	20.38%
Less Important	26	10.00%
Important	60	23.08%
More Important	81	31.15%
Significantly More Important	40	15.38%

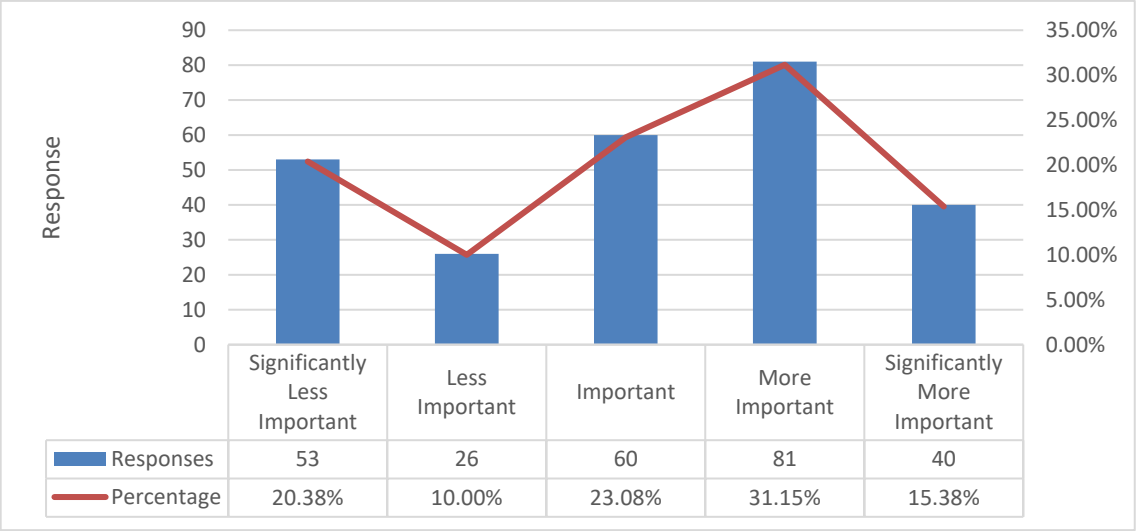

Figure 4.27: Poor Control of the Market for Cheap, Low-Quality Materials Chart.

According to the chart, the percentage of respondents who believe that the lack of oversight regarding the market's low-quality, inexpensive materials is "Significantly More Important" is 15.38%. The percentage of respondents who believe that it is "More Important" is 31.15%. The percentage of respondents who believe that it is "Less Important" is 10.00%. And the percentage of respondents who believe that it is "Significantly Less Important" is 20.38%.

b. Inadequate industrial management for the material manufacturer

Table 4.28: Poor Material Manufacturer Industrial Management.

Importance	Responses	Percentage
Significantly Less Important	17	6.54%
Less Important	54	20.77%
Important	40	15.38%
More Important	149	57.31%
Significantly More Important	0	0.00%

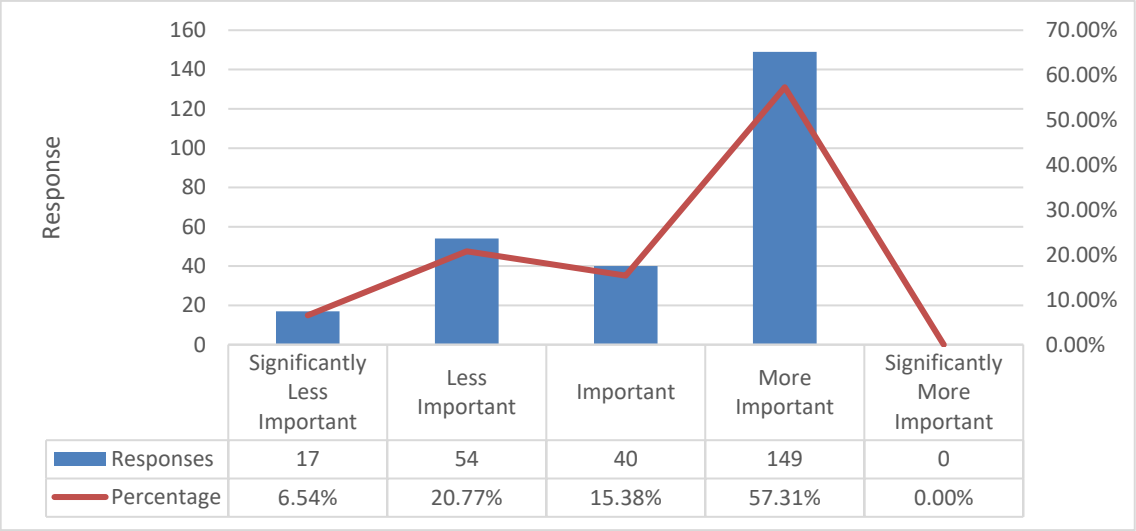

Figure 4.28: Poor Material Manufacturer Industrial Management Chart.

The most important factor, according to the survey, is "Security and privacy of financial data," with 57.31% of respondents rating it as either "More Important." This is followed by "Convenience and ease of use" (20.77% rating it as "less Important") and "Reliability and stability of the mobile financial service" (15.38% rating it as Important).

c. The existing material factories do not have experienced owners or managers.

Table 4.29: Existing Factories Lack Knowledgeable Proprietors and Managers.

Importance	Responses	Percentage
Significantly Less Important	34	13.08%
Less Important	24	9.23%
Important	38	14.62%
More Important	61	23.46%
Significantly More Important	103	39.62%

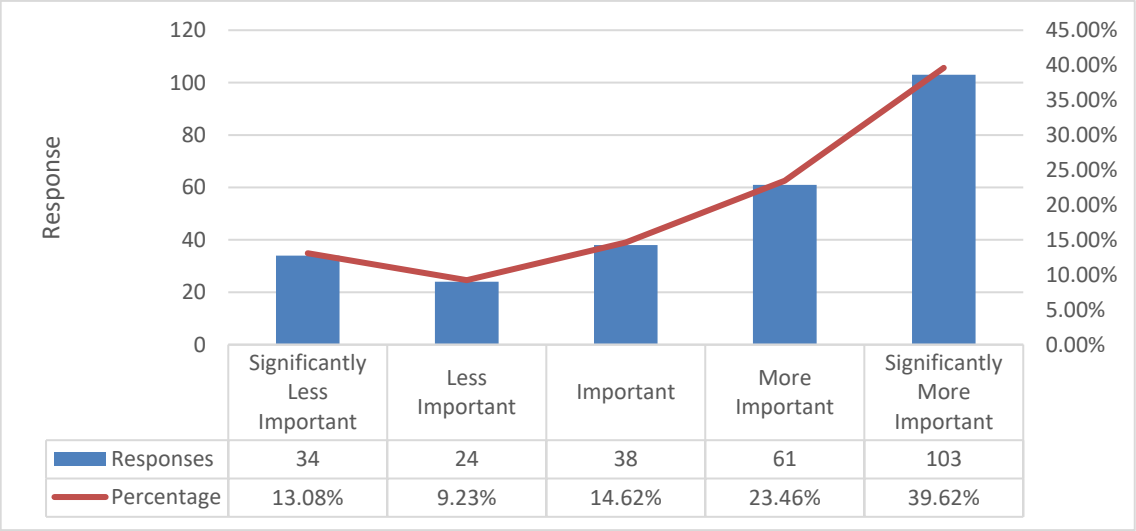

Figure 4.29: Existing Factories Lack Knowledgeable Proprietors and Managers Chart.

It is important to note that this is just interpretation of the data. The specific meaning of the data will depend on the context in which it was collected.. On a 5-Likert scale, where 1 is strongly disagree and 5 is strongly agree, the data suggests that the following is true:

a. 13.08% of respondents significantly less important with the statement.

b. 9.23% of respondents less important with the statement.

c. 14.62% of respondents important with the statement.

d. 23.46% of respondents more important with the statement.

e. 39.62% of respondents significantly more important with the statement.

d. Lack of a knowledgeable advisor and estimation to calculate the project's material requirements.

Table 4.30: No Knowledgeable Advisor or Material Need Estimation for The Project.

Importance	**Responses**	**Percentage**
Significantly Less Important	24	9.23%
Less Important	30	11.54%
Important	74	28.46%
More Important	115	44.23%
Significantly More Important	17	6.54%

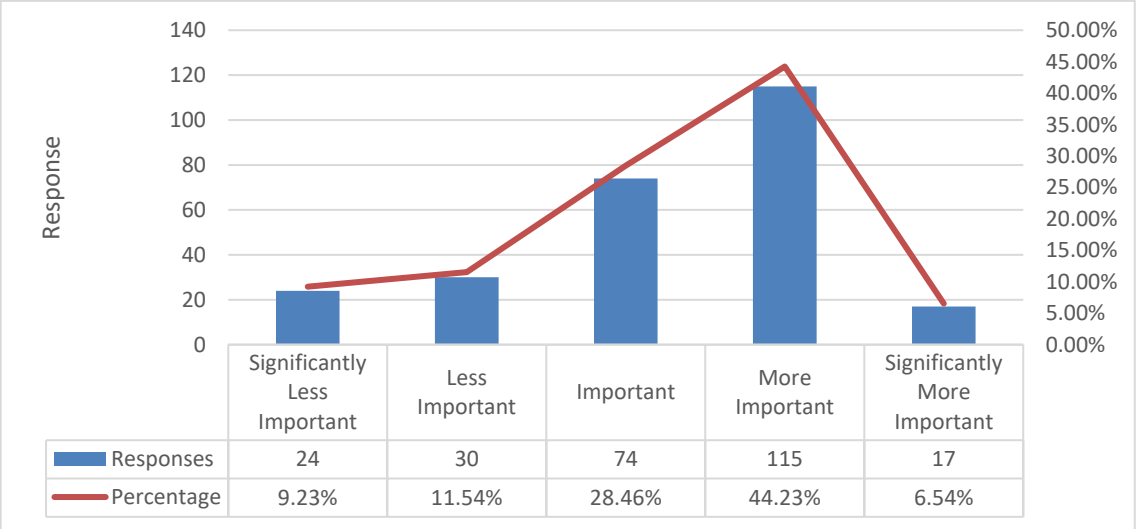

Figure 4.30: No Knowledgeable Advisor or Material Need Estimation for the Project Chart.

a. Significantly Less Important: 9.23% of respondents selected this option for both having a knowledgeable advisor. This suggests that a small minority of engineers believe that these factors are not very important to the success of engineering projects.

b. Less Important: 11.54% of respondents selected this option for having a knowledgeable advisor. This suggests that a larger minority of engineers believe that these factors are somewhat important, but not essential, to the success of engineering projects.

c. Important: 28.46% of respondents selected this option for having a knowledgeable advisor. This suggests that a plurality of engineers believe that these factors are important to the success of engineering projects.

d. More Important: 44.23% of respondents selected this option for having a knowledgeable advisor. This suggests that a significant minority of engineers believe that these factors are very important to the success of engineering projects.

e. Significantly More Important: 6.54% of respondents selected this option for having a knowledgeable advisor. This suggests that a small minority of engineers believe that these factors are essential to the success of engineering projects.

e. Inability to manage construction materials on the job site.

Table 4.31: On Location Construction Material Management Issues.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	43	16.54%
Important	35	13.46%
More Important	69	26.54%
Significantly More Important	89	34.23%

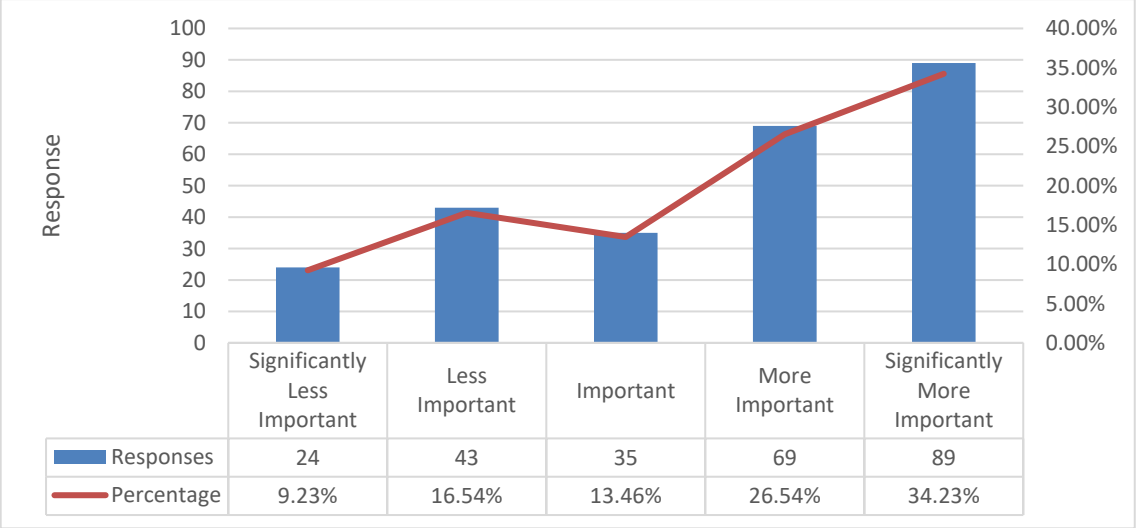

Figure 4.31: On Location Construction Material Management Issues Chart.

a. Significantly Less Important: 9.23% of respondents selected this option, which suggests that a small minority of engineers believe that the inability to manage construction materials is not a very important factor in their work.

b. Less Important: 16.54% of respondents selected this option, indicating that a somewhat larger group of engineers view the inability to manage materials as a somewhat unimportant factor.

c. Important: 13.46% of respondents selected the Important option, suggesting that they are unsure of the importance of this factor.

d. More Important: 26.54% of respondents selected this option, indicating that a significant portion of engineers believe that the inability to manage materials is an important factor in their work.

e. Significantly More Important: 34.23% of respondents selected this option, which suggests that the largest group of engineers view the inability to manage materials as a very important factor in their work.

f. Lack of expertise on the market's material availability among consultants

Table 4.32: Lack of Consultant Market Material Availability Expertise.

Importance	Responses	Percentage
Significantly Less Important	33	12.69%
Less Important	43	16.54%
Important	30	11.54%
More Important	88	33.85%
Significantly More Important	66	25.38%

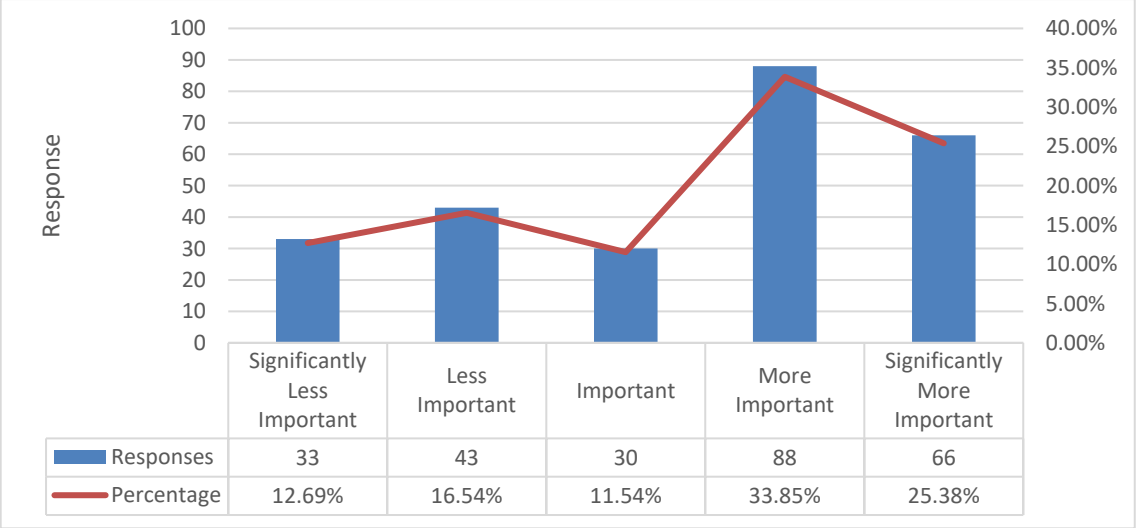

Figure 4.32: Lack of Consultant Market Material Availability Expertise Chart.

The data in the chart suggests that a significant portion of consultants (11.54%) believe that a lack of expertise on the market's material availability is "Important". Another 33.85% of consultants believe it is "More Important", while 16.54% believe it is "Less Important" and 12.69% believe it is "Significantly Less Important". Only 25.38% of consultants believe that a lack of expertise on the market's material availability is "Significantly More Important".

4.3.4 Governmental Laws Causes

a. Government regulations on the sale of construction materials are lacking.

Table 4.33: Government Controls on Construction Material Sales are Inadequate.

Importance	Responses	Percentage
Significantly Less Important	34	13.08%
Less Important	31	11.92%
Important	26	10.00%
More Important	54	20.77%
Significantly More Important	115	44.23%

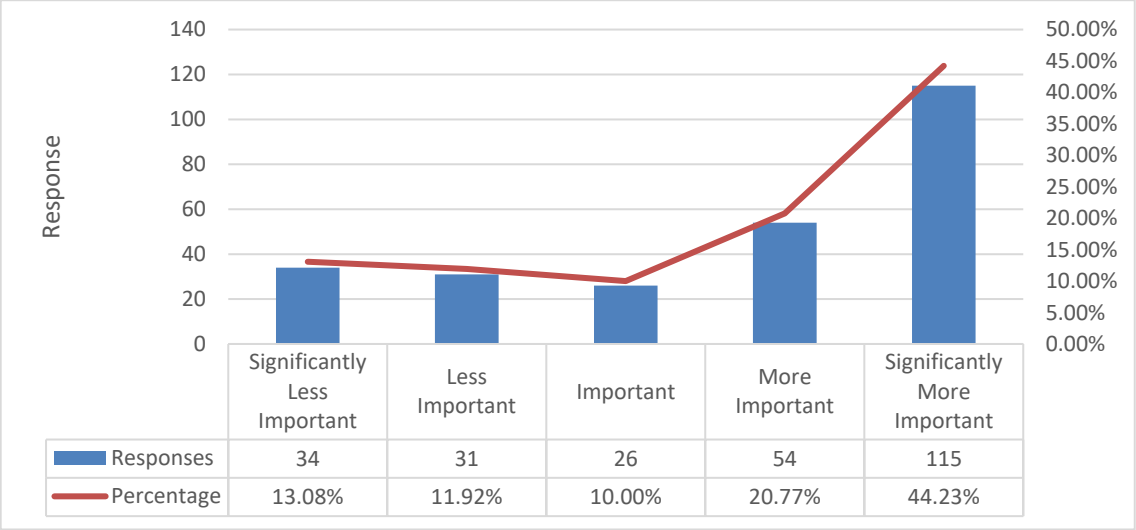

Figure 4.33: Government Controls on Construction Material Sales are Inadequate Chart**.**

The chart shows a line graph with four lines, each representing a different level of agreement with the statement "Government regulations on the sale of construction materials are lacking." The X-axis shows the percentage of respondents who agree with the statement, while the Y-axis shows the level of agreement, from "Strongly disagree" to "Strongly agree."

a. The first line, labelled "Significantly Less Important," shows that 13.08% of respondents believe that government regulations on the sale of construction materials are significantly less important.

b. The second line, labelled "Less Important," shows that 11.92% of respondents believe that government regulations on the sale of construction materials are less important.

c. The third line, labelled "Important," shows that 10% of respondents believe that government regulations on the sale of construction materials are important.

d. The fourth line, labelled "More Important," shows that 20.77% of respondents believe that government regulations on the sale of construction materials are more important.

e. The Fifth line, labelled "Significantly More Important," shows that 44.23% of respondents believe that government regulations on the sale of construction materials are significantly more important.

b. Government regulations governing the specifications of imported building materials are lacking.

Table 4.34: No Government Restrictions on Imported Building Supplies Specifications.

Importance	Responses	Percentage
Significantly Less Important	43	16.54%
Less Important	52	20.00%
Important	18	6.92%
More Important	119	45.77%
Significantly More Important	28	10.77%

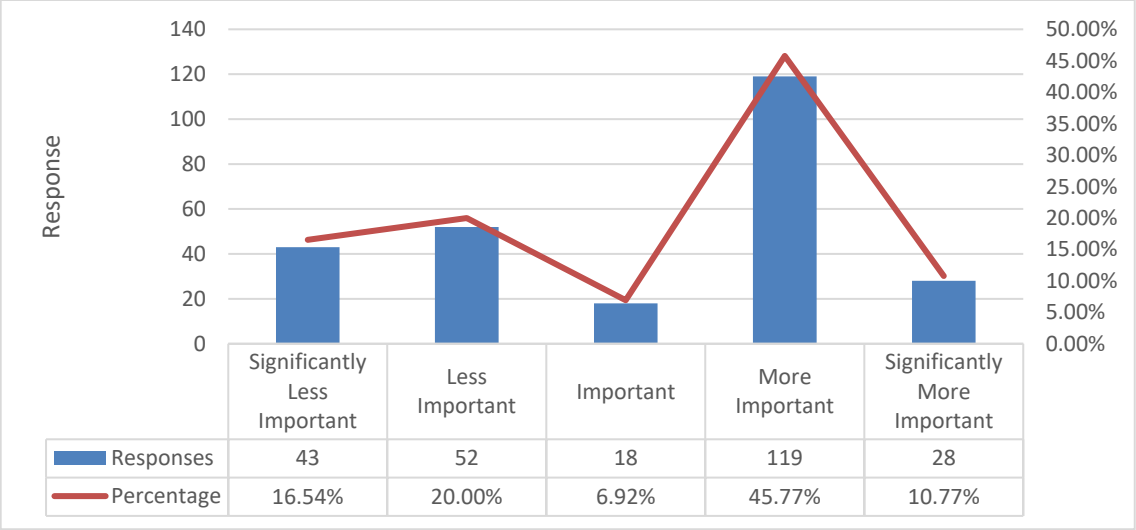

Figure 4.34: No Government Restrictions on Imported Building Supplies Specifications Chart.

The chart shows that a majority of engineers (45.77%), (10.77%) believe that government regulations are "More Important" and "Significantly More Important" when it comes to ensuring the quality of imported building materials. A smaller percentage of engineers (20.00%) and (16.54%) believe that regulations are "Less Important" and "Significantly Less Important". The remaining 6.92% of engineers are Important on the issue.

These results suggest that there is a strong consensus among engineers that government regulations play an important role in ensuring the quality of imported building materials. However, there is also a minority of engineers who believe that regulations are either unnecessary or counterproductive.

c. Every government location has a different set of specifications for building materials.

Table 4.35: Every Government Site Has Different Building Material Needs.

Importance	Responses	Percentage
Significantly Less Important	25	9.62%
Less Important	48	18.46%
Important	69	26.54%
More Important	29	11.15%
Significantly More Important	89	34.23%

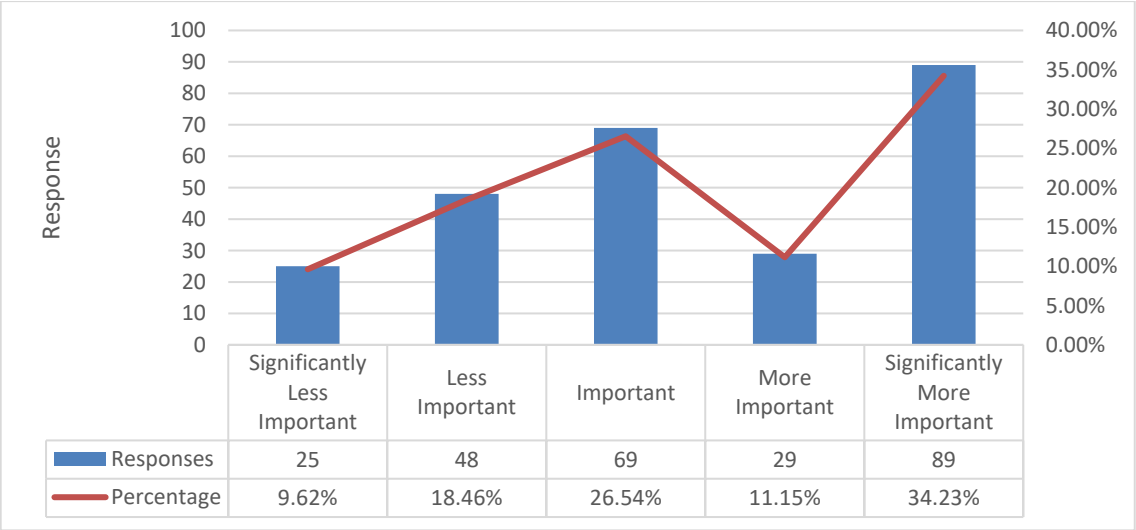

Figure 4.35: Every Government Site Has Different Building Material Needs Chart.

The results are shown in Figure:

a. Significantly less important (1): 9.62% of respondents disagree that every government location has different specifications for building materials. This suggests that some engineers believe there is a degree of standardization across different government locations.

b. Less important (2): 18.46% of respondents somewhat disagree with the statement. This could indicate that they believe there is some variation in specifications, but not to the extent that it is a major problem.

c. Important (3): 26.54% of respondents are Important on the issue. This suggests that they are unsure or have mixed opinions about the level of variation in specifications.

d. More Important (4): 11.15% of respondents somewhat agree with the statement. This indicates that they believe there is a significant amount of variation in specifications, which can create challenges for engineers.

e. Significantly More Important (5): 34.23% of respondents strongly agree that every government location has different specifications for building materials. This is the largest group of respondents, and it suggests that a significant proportion of engineers find the variation in specifications to be a major issue.

Overall, the chart suggests that there is a wide range of opinions among engineers about the level of variation in building material specifications across different government locations. While some engineers believe there is a degree of standardization, others believe that the variation is significant and creates challenges for their work.

d. Corruption that keeps imports from being profitable for producers

Table 4.36: Corruption That Makes Imports Unprofitable for Manufacturers.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	65	25.00%
Important	92	35.38%
More Important	55	21.15%
Significantly More Important	24	9.23%

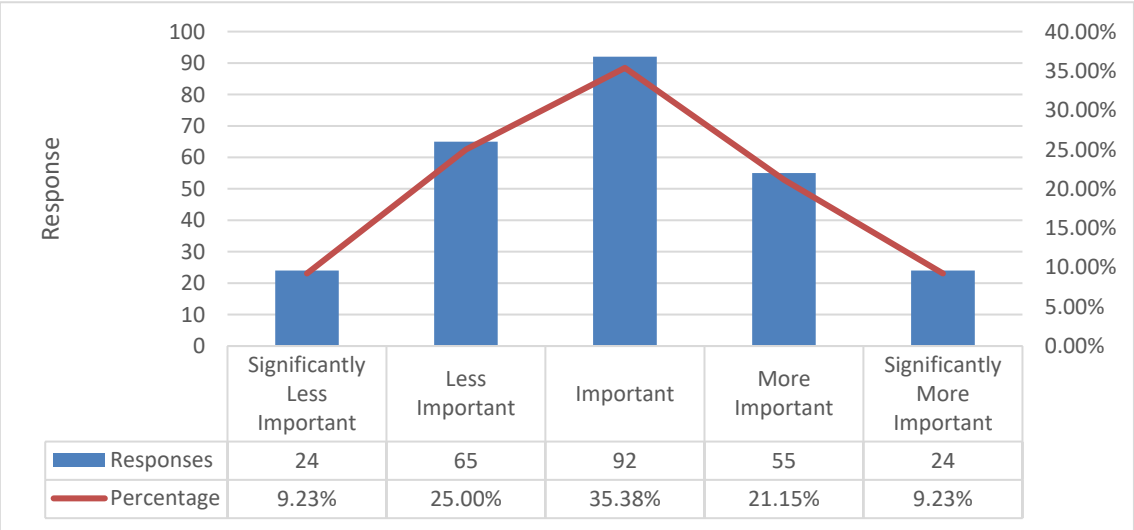

Figure 4.36: Corruption That Makes Imports Unprofitable for Manufacturers Chart.

the chart, using a 5-point Likert scale, where 1 is the least corrupt and 5 is the most corrupt:

a. Significantly More Important: 9.23% of respondents believe that corruption is a very important factor in preventing imports from being profitable for producers. This is the highest percentage for any answer choice, indicating that a significant minority of engineers believe that corruption is a major problem.

b. More Important: 21.15% of respondents believe that corruption is somewhat important in preventing imports from being profitable for producers. This is the second-highest percentage for any answer choice, indicating that a large number of engineers believe that corruption is at least a somewhat significant problem.

c. Less Important: 25% of respondents believe that corruption is not very important in preventing imports from being profitable for producers. This is the third-highest percentage for any answer choice, indicating that a smaller number of engineers believe that corruption is not a major problem.

d. Significantly Less Important: 9.23% of respondents believe that corruption is not at all important in preventing imports from being profitable for producers. This is the lowest percentage for any answer choice, indicating that a small minority of engineers believe that corruption is not a problem.

e. Important: 35.38% of respondents were Important on the importance of corruption in preventing imports from being profitable for producers. This is the second-highest percentage for any answer choice, indicating that a significant number of engineers are unsure about the role of corruption in this issue.

e. Lack of government assistance for managing private manufacturing facilities

Table 4.37: Poor Government Support for Private Manufacturing Facilities.

Importance	Responses	Percentage
Significantly Less Important	62	23.85%
Less Important	27	10.38%
Important	51	19.62%
More Important	92	35.38%
Significantly More Important	28	10.77%

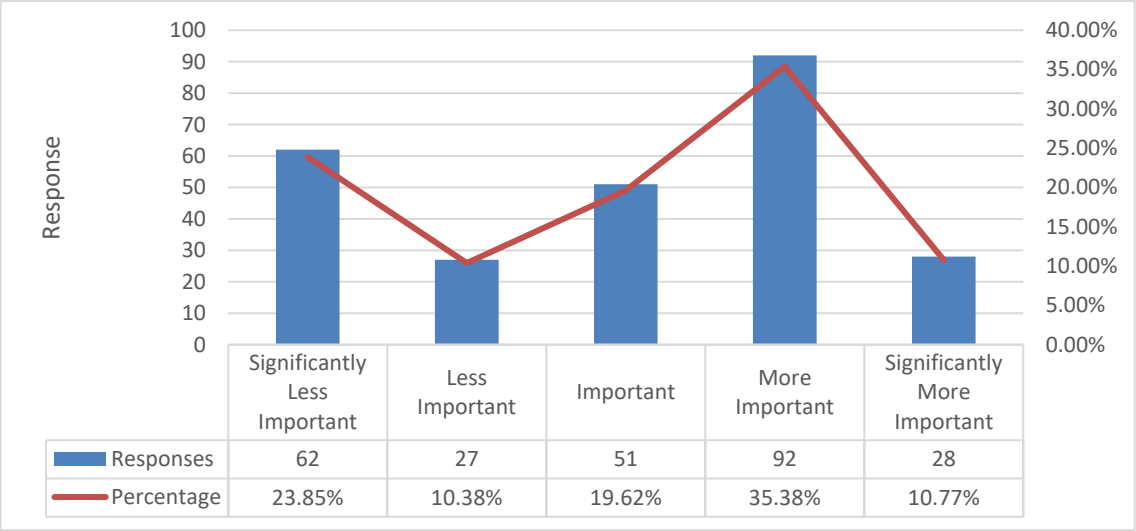

Figure 4.37: Poor Government Support for Private Manufacturing Facilities Chart.

The lines on the chart represent the percentages of respondents who selected each of the four Likert scale options for the statement "Lack of government assistance for managing private manufacturing facilities." The bottom line shows that 23.85% of respondents selected "Significantly Less Important." The second line shows that 10.38% of respondents selected "Less Important." The third line shows that 35.38% of respondents selected "More Important." The top line shows that 10.77% of respondents selected "Significantly More Important."

f. There are no government programs to build and expand new factories.

Table 4.38: The Government Doesn't Have any Plans to Build or Grow New Factories.

Importance	Responses	Percentage
Significantly Less Important	9	3.46%
Less Important	72	27.69%
Important	63	24.23%
More Important	43	16.54%
Significantly More Important	73	28.08%

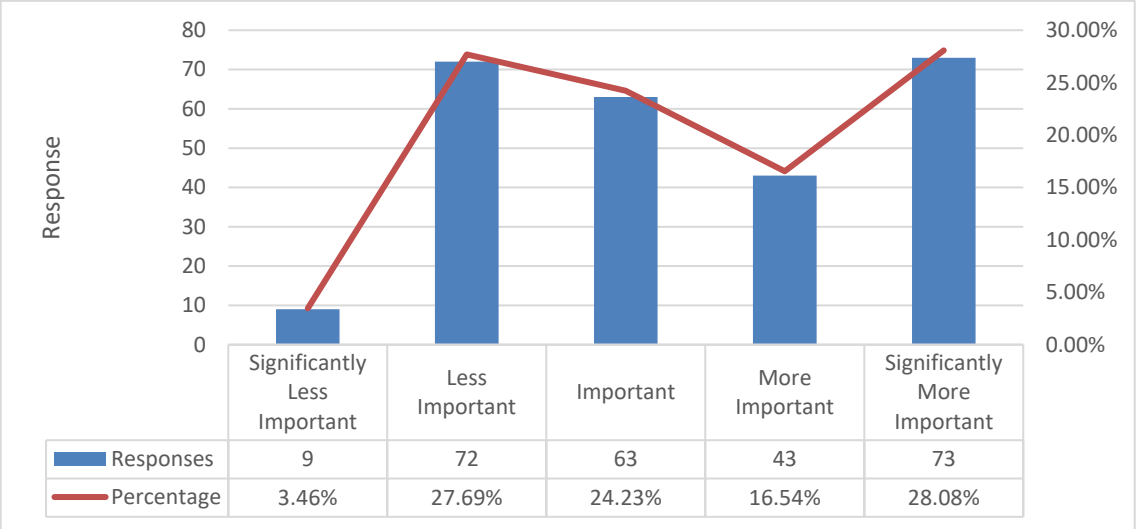

Figure 4.38: The Government Doesn't Have any Plans to Build or Grow New Factories Chart.

Overall, the respondents were slightly Important on the statement, with a mean score of 3.13. This suggests that they neither strongly agree nor strongly disagree that there are no government programs to support the engineering sector.

The distribution of responses is somewhat skewed to the right, with more respondents agreeing with the statement than disagreeing. This suggests that there is a perception among some respondents that the government is not doing enough to support the engineering sector.

The largest group of respondents (24.23%) selected the Important option (3 on the Likert scale). This suggests that many respondents are unsure about the extent of government support for the engineering sector.

A smaller but significant group of respondents (16.54%) selected the "More Important" option (4 on the Likert scale). This suggests that these respondents believe that the government needs to do more to support the engineering sector.

The smallest group of respondents (3.46%) selected the "significantly less impoertant" option (5 on the Likert scale). This suggests that a very small number of respondents believe that there are no government programs at all to support the engineering sector.

g. Financial issues and an unstable economy

Table 4.39: Problems with Money and A Weak Economy.

Importance	Responses	Percentage
Significantly Less Important	36	13.85%
Less Important	33	12.69%
Important	38	14.62%
More Important	139	53.46%
Significantly More Important	14	5.38%

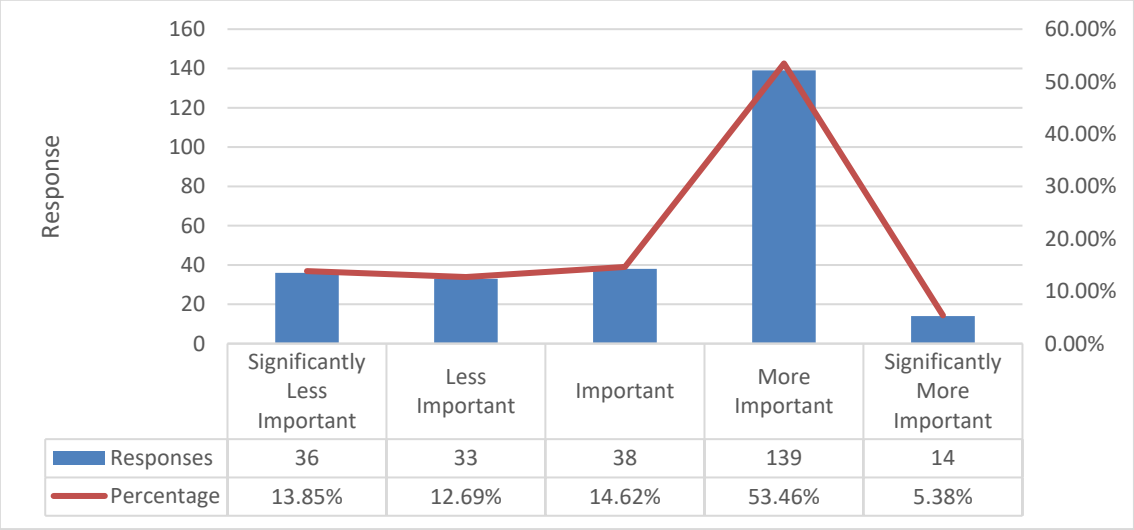

Figure 4.39: Problems with Money and A Weak Economy Chart.

Based on the graph, it appears that financial issues and an unstable economy are a relatively important factor in the decision to pursue an engineering career. Among the participants, the highest percentage, 53.46%, said that financial issues and an unstable economy were a very important factor in their decision.

h. Issues with safety, particularly during material transfers

Table 4.40: Safety Concerns, Especially During Material Transfers.

Importance	Responses	Percentage
Significantly Less Important	23	8.85%
Less Important	28	10.77%
Important	72	27.69%
More Important	15	5.77%
Significantly More Important	122	46.92%

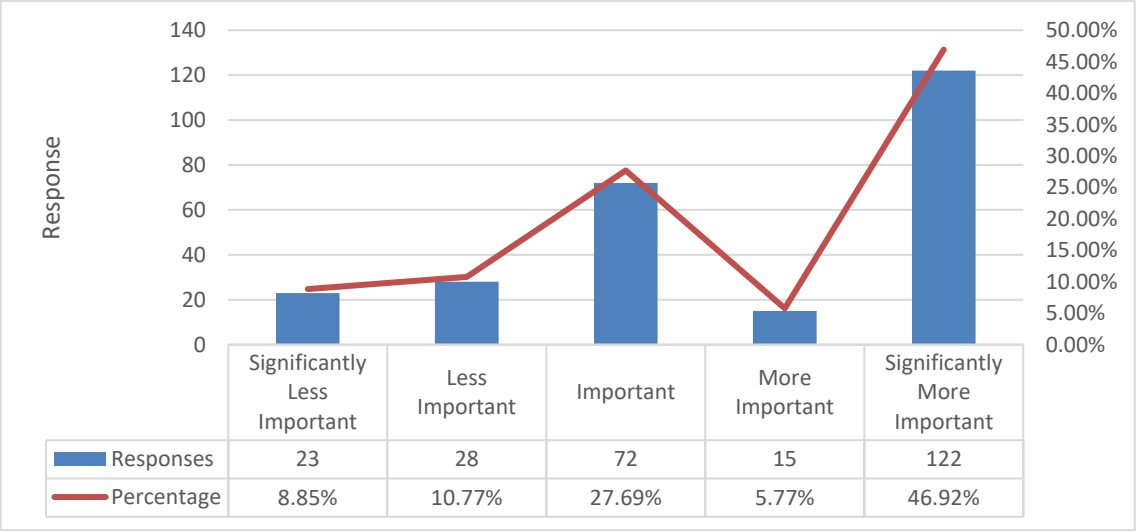

Figure 4.40: Safety Concerns, Especially During Material Transfers Chart.

a. 8.85% of respondents significantly less important with the statement.

b. 10.77% of respondents less important with the statement.

c. 27.69% of respondents important with the statement.

d. 5.77% of respondents more important with the statement.

e. 46.92% of respondents significantly more important with the statement.

4.3.5 Management Causes

a. Absence of sources for building supplies

Table 4.41: Lack of Building Materials.

Importance	Responses	Percentage
Significantly Less Important	51	19.62%
Less Important	44	16.92%
Important	48	18.46%
More Important	89	34.23%
Significantly More Important	28	10.77%

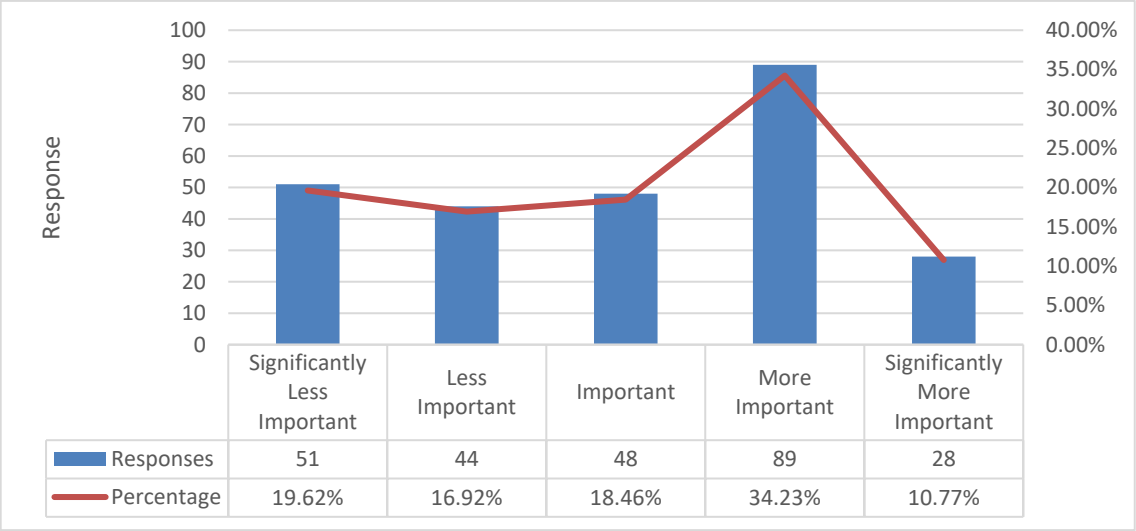

Figure 4.41: Lack of Building Materials Chart.

Here is a more detailed analysis of the data, using a 5-point Likert scale:

a. Significantly less important (1): 19.62% of respondents selected this option. This suggests that these respondents believe that there is a readily available supply of building materials for engineers.

b. Less important (2): 16.92% of respondents selected this option. This suggests that these respondents believe that there is some difficulty in finding building materials, but it is not a major problem.

c. Important (3): 18.46% of respondents selected this option. This suggests that these respondents are unsure about the availability of building materials, or that they have not had any problems finding them themselves.

d. More important (4): 34.23% of respondents selected this option. This suggests that these respondents believe that there is a significant problem with the availability of building materials, and that it is making it difficult for engineers to do their jobs.

e. Significantly more important (5): 10.77% of respondents selected this option. This suggests that these respondents believe that the absence of building materials is a very serious problem, and that it is having a major impact on the engineering field.

Overall, the chart suggests that the absence of sources for building supplies is a moderate problem in the engineering fields. However, it is important to note that there is a significant

minority of engineers who do not experience this problem. More research is needed to determine the extent of the problem and to identify the factors that are contributing to it.

b. Code requirements are not being updated to reflect the market.

Table 4.42: Code Rules are not Updated for Market Changes.

Importance	Responses	Percentage
Significantly Less Important	44	16.92%
Less Important	47	18.08%
Important	122	46.92%
More Important	23	8.85%
Significantly More Important	24	9.23%

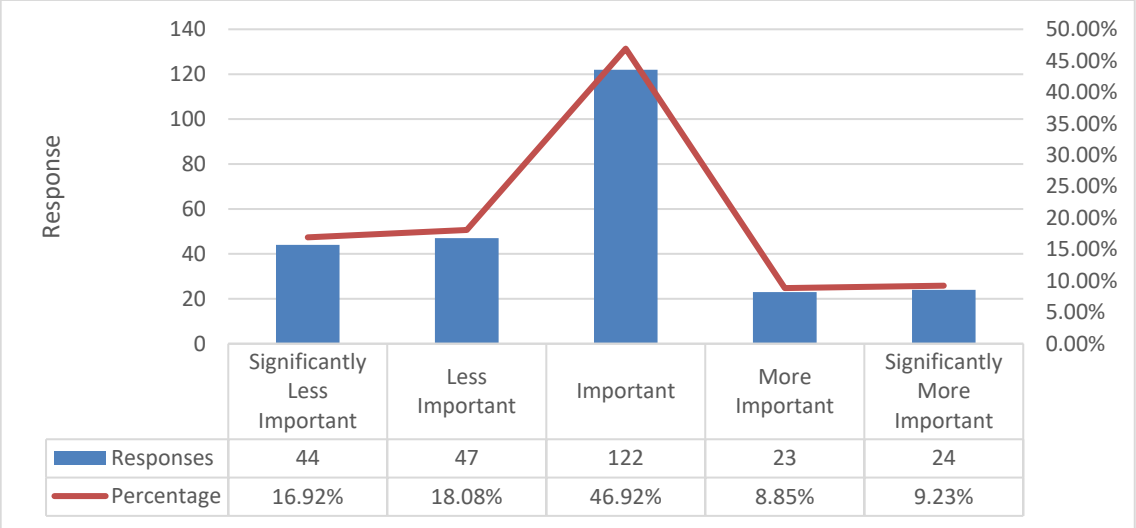

Figure 4.42: Code Rules are not Updated for Market Changes Chart.

Important responses are most prevalent: The highest percentage of responses (46.92%) falls within the " Important" category, indicating a substantial degree of uncertainty or ambivalence regarding the statement's accuracy.

Concern about code updates is evident: Notably, 35.23% of respondents express some level of concern about code requirements not aligning with market needs, with 18.08% selecting "Less Important" and 16.92% choosing "Significantly Less Important."

A minority perceives code updates as crucial: A smaller proportion of respondents (8.85%) views code updates as more important, suggesting varying perspectives on the urgency of this issue.

c. The project lacks a material management system.

Table 4.43: No Material Management System Exists for the Project.

Importance	Responses	Percentage
Significantly Less Important	24	9.23%
Less Important	45	17.31%
Important	84	32.31%
More Important	58	22.31%
Significantly More Important	49	18.85%

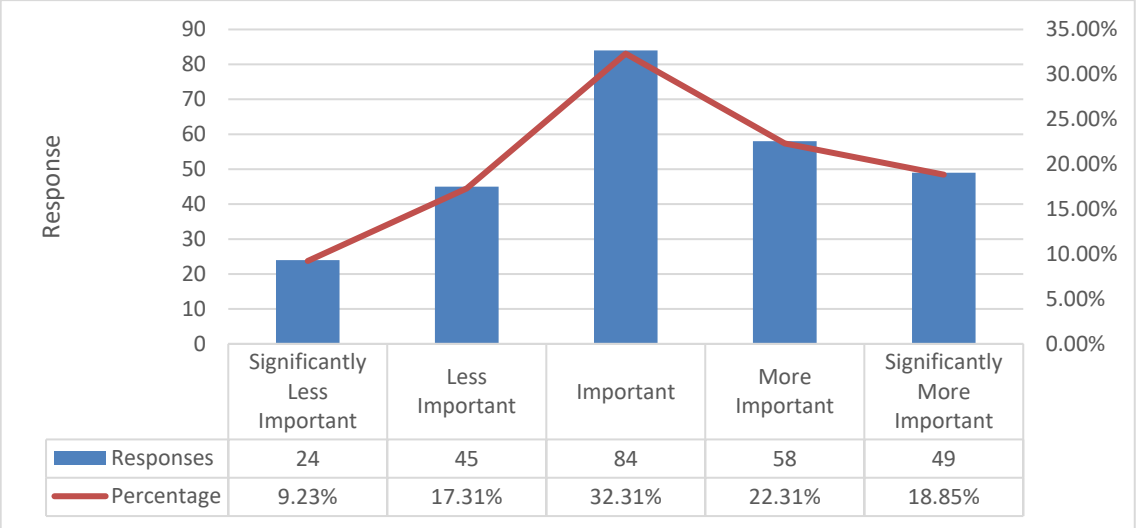

Figure 4.43: No Material Management System Exists for the Project Chart.

The chart also shows that the most common rating for the importance of a material management system is 3 (important), which was selected by 32.31% of respondents. The next most common rating is 5 (more important), which was selected by 22.31% of respondents.

d. Lack of update of material requirements and availability as the project progresses

Table 4.44: Lack of Project-Related Material Needs and Availability Updates.

Importance	Responses	Percentage
Significantly Less Important	43	16.54%
Less Important	12	4.62%
Important	67	25.77%
More Important	105	40.38%
Significantly More Important	33	12.69%

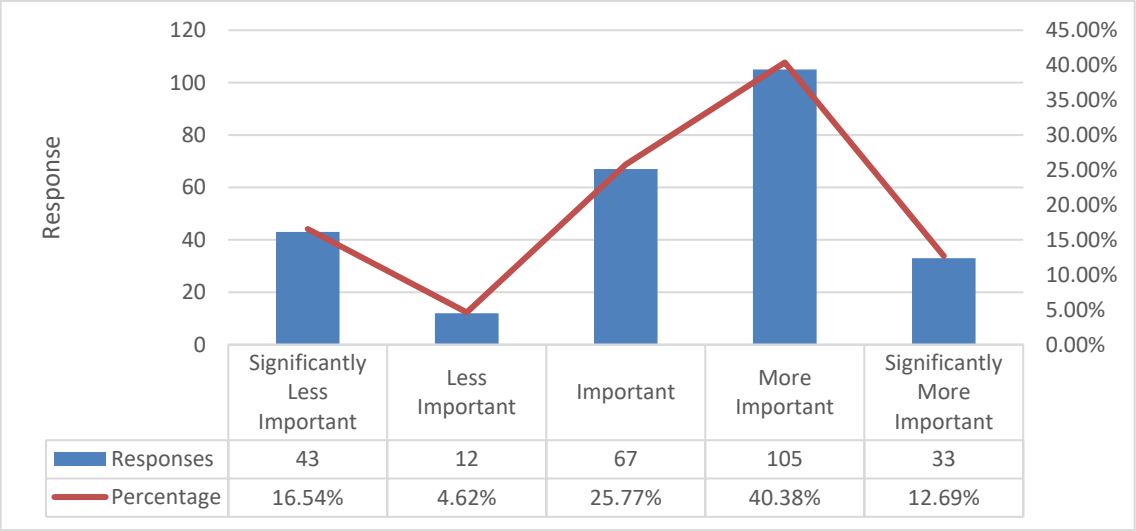

Figure 4.44: Lack of Project-Related Material Needs and Availability Updates Chart.

The data for the chart comes from a survey of engineers who were asked to rate the importance of keeping material requirements and availability up-to-date as a project progresses. The survey results show that the majority of engineers (40.38%) believe that this is more important factor. However, a significant minority of engineers (25.77%) (16.54%) believe that it is less important and significantly less important.

The chart can be interpreted in several ways. One interpretation is that engineers are generally aware of the importance of keeping material requirements and availability up-to-date, but that there is some disagreement about how important this factor is. Another interpretation is that engineers who work on projects with complex material requirements are more likely to believe that this factor is important.

e. Lack of a good plan for material storage

Table 4.45: Weak Material Storage Plan.

Importance	Responses	Percentage
Significantly Less Important	43	16.54%
Less Important	27	10.38%
Important	88	33.85%
More Important	87	33.46%
Significantly More Important	15	5.77%

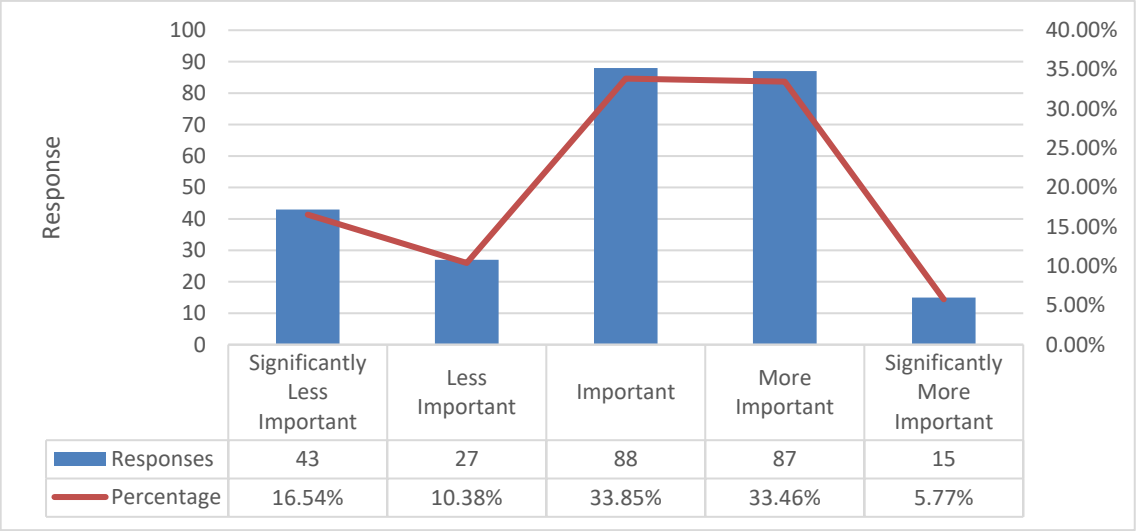

Figure 4.45: Weak Material Storage Plan Chart.

The chart shows that the most common response was that having a good plan for material storage is More Important. This was selected by 33.85% of respondents. The next most common response was that having a good plan for material storage is Less Important. This was selected by 10.38% of respondents. The least common responses were that having a good plan for material storage is Significantly Less Important or Significantly More Important. These were selected by 16.54% and 5.77% of respondents, respectively.

f. The project's lack of adequate material storage

Table 4.46: The Project's Inadequate Material Storage.

Importance	Responses	Percentage
Significantly Less Important	33	12.69%
Less Important	49	18.85%
Important	23	8.85%
More Important	124	47.69%
Significantly More Important	31	11.92%

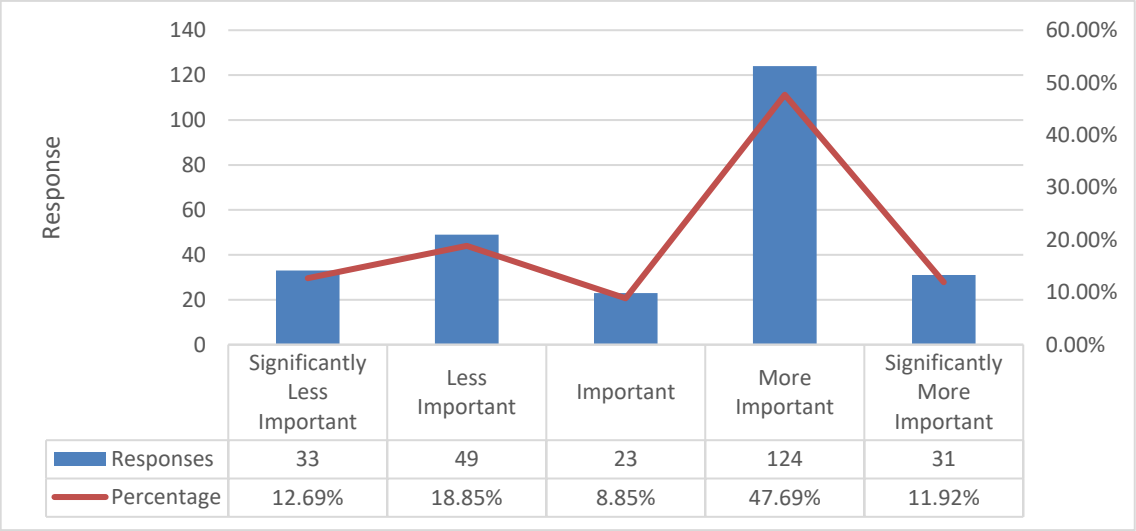

Figure 4.46: The Project's Inadequate Material Storage Chart.

The chart shows that the most common response was "More Important," with 47.69% of respondents saying that the lack of adequate material storage was an important factor in the project. The next most common response was "Less Important," with 18.85% of respondents saying that it was not an important factor. The least common responses were "Significantly Less Important" and "Significantly More Important," with 12.69% and 11.92% of respondents saying that it was very important or very not important, respectively.

4.4 FINAL SUMMARY

The Result from the survey comes with this two most factor that makes the effects to the delay in Iraqi construction project.

a. Significant factors were determined through the assessment of the provided variables. Based on the analysis of the responses received and use (IMPI) to the collected data, we assessed the significance of material shortage as a contributing factor to other causes of delay. The statement the occurrence of delays in building projects can be attributed to material shortages, which is a well-recognized factor. This is particularly evident given that most of those surveyed were experienced professionals actively engaged in the construction industry. One of the prevailing issues within the construction sector in Iraq pertains to project suspensions resulting from material shortages. Such delays have a detrimental impact on all project activities. The issue of suspension frequently extends

beyond a transient concern. Occasionally, there is a considerable time-lapse of several months before the recommencement of a project.

b. The primary technical issue that resulted in a shortage of materials, in comparison to other technical concerns, was the lack of a knowledgeable and qualified employee at the customs facility who could effectively navigate code requirements. One prominent issue that arises is the dearth of seasoned proprietors or investors to oversee the operational activities of the extant material manufacturing facilities. This particular predicament is responsible for a substantial portion, over 40%, of the whole financial deficit in comparison to other issues pertaining to expertise. The primary management issue observed in the projects was the absence of an effective material management system, which consequently led to negative outcomes. Similarly, a significant challenge faced by the government category was the temporary closure of local plants responsible for material production, resulting in adverse consequences.

5. CONCLUSIONS

5.1 CONCLUSIONS

The study successfully accomplished its two objectives by doing thorough research. The aims of this study have been thoroughly elucidated over the course of this investigation. The subsequent section presents a synthesis of all the research findings.

a. The goal of this study is to figure out how important shortages of supplies are compared to other things that cause delays in projects.

   The main goal of this research project was to find out how important shortages of materials were compared to other things that caused delays. The goal was met by analysing questionnaire survey data from 260 construction workers in Iraq who work or have worked in the construction industry in the past. The problem of not having enough materials was looked at considering other issues using (IMPI) method. The scores were looked at to see where and how material shortages affected things, and the results are shown.

b. This aims to categorize and evaluate the problems that contribute to material shortages.

   The second purpose of this study aimed to classify the factors contributing to material shortages into four primary categories and thereafter assess each factor, comparing it to other factors within the same category. The stated objective was successfully accomplished by conducting a thorough analysis of the gathered data and survey results using the (AHP) method.

5.2 FUTURE WORKS

This study provides valuable insights into the topic at hand. Based on the findings and limitations of this study, some recommendations for further research can be made.

a. This study (provides) is useful information about the subject at hand. Some suggestions for more research can be made based on what this study found and what it couldn't do.

b. The only thing that this study investigates is the building business in Iraq. But it is still important to do more study in every Iraqi city to investigate things like community dynamics, economic conditions, and other problems that might be unique to each city.

c. If you are keen to learn more about the results of this study, you could use case studies to do more detailed research. The building industry would benefit more from incorporating the traits that were highlighted into the different stages of a project's life cycle. The goal of this study is to find out how shortages of building materials affect the timing of construction projects in Iraq.

d. More study could be done on these results through qualitative research that aims to find ways to reduce the delays in Iraq's construction projects caused by a lack of materials.

e. The Iraqi construction business needs to create a system for managing construction materials, keep accurate records of data management, and keep a close eye on construction materials.

f. Education schools might think about adding classes that explain the problem of material shortages and teach good ways to deal with them, to improve hands-on training and build more expertise.

g. To properly evaluate and analyse the specifications of imported materials, it is suggested that specialized technical offices be set up and staffed by qualified engineers and technicians. This step makes sure that all orders follow the rules and guidelines that have been set.

h. Start to study projects to determine how owners or owners ought to do in the construction supplies market based on their factory management experience. Thus, the government must prevent tainted money from entering plant projects and ensure qualified operators.

i. This plan aims to give the government a complete way to keep an eye on the market, with the main goal of making sure that all building products meet all applicable building codes.

j. It is proposed that a government system be set up to work with reputable academic institutions to create long-lasting laws that regulate building materials. Stress how important it is to keep updating and adjusting current codes to meet the needs of the market.

k. It is significant to learn everything you can about management software and apps so that you can keep an eye on how projects are going and make sure that the project list has all the materials you require. This will make it easier to keep learning and training about management apps. The focus of this study was only on the construction business in Iraq, but it's likely that the results can be applied to building projects in other parts of Iraq as well. These results should help everyone involved in the building industry—including the government and contractors, consultants, owners, and clients—avoid delays.

REFERENCES

[1] M. Tian and X. Sheng, "CPT-Based Probabilistic Characterization of Undrained Shear Strength of Clay," *Advances in Civil Engineering*, vol. 2020, pp. 1–15, Feb. 2020, doi: 10.1155/2020/9617698.

[2] Cosenza, E Manfredi, G Pecce, M Realfonzo, R "Bond between Glass Fiber Reinforced Plastic Reinforcing Bars and Concrete—Experimental Analysis," in *SP-188: 4th Intl Symposium - Fiber Reinforced Polymer Reinforcement for Reinforced Concrete Structures*, American Concrete Institute, 1999. doi: 10.14359/5636.

[3] A. I. Mohammed, S. Naimi, and A. S. Dawood, "Evaluation of the Drinking and Irrigation Quality of Groundwater in Basra, Iraq," *Journal of Ecological Engineering*, vol. 24, no. 9, pp. 260–271, Sep. 2023, doi: 10.12911/22998993/169177.

[4] H.R. Viswanath, Jurek Tolloczko, J.N. Clarke "Engineering problems and approaches of high-rise buildings in Shenzhen, China," in *Multi-purpose High-rise Towers and Tall Buildings*, CRC Press, 2003, pp. 15–24. doi: 10.1201/9781482272048-7.

[5] Z. Al-Tameemi, S. Naimi, and L. Mubarak, "Numerical investigation of the dynamic soil-structure interaction of concrete buildings," *Journal of Applied Engineering Science*, vol. 21, no. 2, pp. 440–450, 2023, doi: 10.5937/jaes0-40083.

[6] M. Sambasivan and Y. W. Soon, "Causes and effects of delays in Malaysian construction industry," *International Journal of Project Management*, vol. 25, no. 5, pp. 517–526, Jul. 2007, doi: 10.1016/j.ijproman.2006.11.007.

[7] T. Parker, "The role of cryptography in global communications," *Network Security*, vol. 1996, no. 5, pp. 13–17, May 1996, doi: 10.1016/1353-4858(96)81910-6.

[8] Z. Rachid, B. Toufik, and B. Mohammed, "Causes of schedule delays in construction projects in Algeria," *International Journal of Construction Management*, vol. 19, no. 5, pp. 371–381, Sep. 2019, doi: 10.1080/15623599.2018.1435234.

[9] J. Wang, Y. Qin, S. Huo, K. Xie, and Y. Li, "Numerical Simulation of Nanofluid-Based Parallel Cooling Photovoltaic Thermal Collectors," *Journal of Thermal Science*, vol. 32, no. 4, pp. 1644–1656, Jul. 2023, doi: 10.1007/s11630-023-1741-y.

[10] G. P. Usman, “Delays and Cost Overruns in Construction Projects in Nigeria: Causes and Remedies,” *International Journal of Innovative Research and Development*, vol. 9, no. 8, Aug. 2020, doi: 10.24940/ijird/2020/v9/i8/APR20012.

[11] S. O. Ogunlana, K. Promkuntong, and V. Jearkjirm, “Construction delays in a fast-growing economy: Comparing Thailand with other economies,” *International Journal of Project Management*, vol. 14, no. 1, pp. 37–45, Feb. 1996, doi: 10.1016/0263-7863(95)00052-6.

[12] Kenneth Matthews “Book Reviews : Documents on British Foreign Policy, 1919-1939. First Series, Vol. XVIII. Greece & Turkey 1922-1923. 1064 pages. Documents on British Foreign Policy, 1919-1939. Series IA Vol. IV. European & Security Questions 1927-1928. 668 pages. Her Majesty’s Stationery Office. £11.75 and £7.75 respectively,” *International Relations*, vol. 4, no. 1, pp. 120–121, Apr. 1972, doi: 10.1177/004711787200400110.

[13] de Perthuis C “The price of carbon: the economics of projects,” in *Economic Choices in a Warming World*, Cambridge University Press, 2011, pp. 146–168. doi: 10.1017/CBO9780511753619.007.

[14] T. Hegazy and W. Menesi, “Delay Analysis under Multiple Baseline Updates,” *J Constr Eng Manag*, vol. 134, no. 8, pp. 575–582, Aug. 2008, doi: 10.1061/(ASCE)0733-9364(2008)134:8(575).

[15] J. McGarry and B. O’Leary, “Iraq’s Constitution of 2005: Liberal consociation as political prescription,” *Int J Const Law*, vol. 5, no. 4, pp. 670–698, Sep. 2007, doi: 10.1093/icon/mom026.

[16] B. Cavusoglu and E. A. Oral, “Estimation of available bandwidth share by tracking unknown cross-traffic with adaptive extended Kalman filter,” *Comput Commun*, vol. 47, pp. 34–50, Jul. 2014, doi: 10.1016/j.comcom.2014.04.008.

[17] M. M. Marzouk and T. I. El-Rasas, “Analyzing delay causes in Egyptian construction projects,” *J Adv Res*, vol. 5, no. 1, pp. 49–55, Jan. 2014, doi: 10.1016/j.jare.2012.11.005.

[18] N. Mansfield, O. Ugwu, and T. Doran, “Causes of delay and cost overruns in Nigerian construction projects,” *International Journal of Project Management*, vol. 12, no. 4, pp. 254–260, Nov. 1994, doi: 10.1016/0263-7863(94)90050-7.

[19] I. Mahdi and E. Soliman, “Significant and top ranked delay factors in Arabic Gulf countries,” *International Journal of Construction Management*, vol. 21, no. 2, pp. 167–180, Feb. 2021, doi: 10.1080/15623599.2018.1512029.

[20] S. Lindhard and S. Wandahl, “Exploration of the reasons for delays in construction,” *International Journal of Construction Management*, vol. 14, no. 1, pp. 36–44, Jan. 2014, doi: 10.1080/15623599.2013.875267.

[21] M. M. Kumaraswamy and D. W. M. Chan, “Contributors to construction delays,” *Construction Management and Economics*, vol. 16, no. 1, pp. 17–29, Jan. 1998, doi: 10.1080/014461998372556.

[22] G. Kikwasi, “Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania,” *Australasian Journal of Construction Economics and Building - Conference Series*, vol. 1, no. 2, p. 52, Feb. 2013, doi: 10.5130/ajceb-cs.v1i2.3166.

[23] M. Khoshgoftar, A. H. A. Bakar, and O. Osman, “Causes of Delays in Iranian Construction Projects,” *International Journal of Construction Management*, vol. 10, no. 2, pp. 53–69, Jan. 2010, doi: 10.1080/15623599.2010.10773144.

[24] P. F. Kaming, P. O. Olomolaiye, G. D. Holt, and F. C. Harris, “Factors influencing construction time and cost overruns on high-rise projects in Indonesia,” *Construction Management and Economics*, vol. 15, no. 1, pp. 83–94, Jan. 1997, doi: 10.1080/014461997373132.

[25] S. Neamat, “Investigating and analyzing the most important delay causes in Kurdistan Building Construction Projects,” *Journal of Civil Engineering Frontiers*, vol. 2, no. 01, pp. 08–12, Jun. 2021, doi: 10.38094/jocef20132.

[26] B. AL MANNAI, S. M. A. SULIMAN, and Y. AL ALAWAI, “AN INVESTIGATION INTO THE EFFECTS OF THE APPLICATION OF TQM, TPM, AND JIT ON PERFORMANCE OF INDUSTRY IN BAHRAIN,”

INTERNATIONAL JOURNAL OF INDUSTRIAL ENGINEERING RESEARCH AND DEVELOPMENT, vol. 8, no. 1, Feb. 2017, doi: 10.34218/IJIERD.8.1.2017.002.

[27] B. Indhu and K. Yogeswari, "Structural Equation Modelling (SEM) Approach On Inappropriate Construction Equipment Delay Factors," *Civil Engineering Journal*, vol. 7, no. 7, pp. 1156–1168, Jul. 2021, doi: 10.28991/cej-2021-03091717.

[28] G. M. Koot, "David Felix. Keynes: A Critical Life. (Contributions in Economics and Economic History.) Westport, Conn.: Greenwood Publishing Group, Inc. 1999 Pp. xvii, 322. $69.50. ISBN 0-313-28827-5.," *Albion*, vol. 32, no. 3, pp. 536–537, Jun. 2000, doi: 10.2307/4053962.

[29] M. Haseeb, X. Lu, A. Bibi, M. Dyian, and W. Rabbani, "PROBLEMS OF PROJECTS AND EFFECTS OF DELAYS IN THE CONSTRUCTION INDUSTRY OF PAKISTAN," *Australian Journal of Business and Management Research*, vol. 01, no. 06, pp. 41–50, Jan. 2012, doi: 10.52283/NSWRCA.AJBMR.20110106A05.

[30] M. I. Haque, "DO OIL RENTS DETER FOREIGN DIRECT INVESTMENT? THE CASE OF SAUDI ARABIA," *International Journal of Energy Economics and Policy*, vol. 11, no. 1, pp. 212–218, Dec. 2020, doi: 10.32479/ijeep.10359.

[31] M. Gündüz, Y. Nielsen, and M. Özdemir, "Quantification of Delay Factors Using the Relative Importance Index Method for Construction Projects in Turkey," *Journal of Management in Engineering*, vol. 29, no. 2, pp. 133–139, Apr. 2013, doi: 10.1061/(ASCE)ME.1943-5479.0000129.

[32] R. A. Okereke, M. Zakariyau, and E. C. Eze, "Extension of time (EoT) claims substantiation and associated issues in Complex-Multi Stakeholders' building construction contracts," *ITEGAM- Journal of Engineering and Technology for Industrial Applications (ITEGAM-JETIA)*, vol. 7, no. 32, 2021, doi: 10.5935/jetia.v7i32.782.

[33] Gashahun, A. D. "Causes and Effects of Delay on African Construction Projects: A State of the Art Review," *Civil and Environmental Research*, May 2020, doi: 10.7176/CER/12-5-04.

[34] A. B. Carvalho, L. M. F. Maués, F. de S. Moreira, and C. J. L. Reis, “Study on the factors of delay in construction works,” *Ambiente Construído*, vol. 21, no. 3, pp. 27–46, Sep. 2021, doi: 10.1590/s1678-86212021000300536.

[35] H. Doloi, A. Sawhney, K. C. Iyer, and S. Rentala, “Analysing factors affecting delays in Indian construction projects,” *International Journal of Project Management*, vol. 30, no. 4, pp. 479–489, May 2012, doi: 10.1016/j.ijproman.2011.10.004.

[36] L. AL musawi and S. Naimi, “The management of construction projects in Iraq and the most important reasons for the delay,” *Acta logistica*, vol. 10, no. 1, pp. 61–70, Mar. 2023, doi: 10.22306/al.v10i1.351.

[37] A. Kavuma, J. Ock, and H. Jang, “Factors influencing Time and Cost Overruns on Freeform Construction Projects,” *KSCE Journal of Civil Engineering*, vol. 23, no. 4, pp. 1442–1450, Apr. 2019, doi: 10.1007/s12205-019-0447-x.

[38] Y. Bayramoğlu, “Postcolonial surveillance. Europe’s border technologies between colony and crisis **Postcolonial surveillance. Europe’s border technologies between colony and crisis** , by Anouk Madörin, Lanham, Boulder, New York, London, Rowman & Littlefield, 2022, 167 pages, £81(hard cover), £35(ebook), ISBN 978-1-53816-503-4,” *Ethn Racial Stud*, pp. 1–3, Dec. 2023, doi: 10.1080/01419870.2023.2286320.

[39] H. Mohammed Jihad, “CHECKLIST OF BIVALVIA (MOLLUSCA) IN IRAQ,” *Bulletin of the Iraq Natural History Museum*, vol. 17, no. 4, pp. 589–610, Dec. 2023, doi: 10.26842/binhm.7.2023.17.4.0589.

[40] J. R. Baldwin, J. M. Manthei, H. Rothbart, and R. B. Harris, “Causes of Delay in the Construction Industry,” *Journal of the Construction Division*, vol. 97, no. 2, pp. 177–187, Nov. 1971, doi: 10.1061/JCCEAZ.0000305.

[41] M. S. Bajjou and A. Chafi, “Empirical study of schedule delay in Moroccan construction projects,” *International Journal of Construction Management*, vol. 20, no. 7, pp. 783–800, Sep. 2020, doi: 10.1080/15623599.2018.1484859.

[42] R. Al-Musawi and S. Naimi, “Evaluation of Construction Project’s Cost Using BIM Technology,” *Mathematical Modelling of Engineering Problems*, vol. 10, no. 2, pp. 469–476, Apr. 2023, doi: 10.18280/mmep.100212.

[43] S. A. Assaf and S. Al-Hejji, “Causes of delay in large construction projects,” *International Journal of Project Management*, vol. 24, no. 4, pp. 349–357, May 2006, doi: 10.1016/j.ijproman.2005.11.010.

[44] A. Alkhuadhan and S. Naimi, “A new model for cost estimation construction project using Hybrid importance regression ensemble method,” *Acta logistica*, vol. 10, no. 2, pp. 191–198, Jun. 2023, doi: 10.22306/al.v10i2.372.

[45] H. Hasan, S. Naimi, and M. M. Hameed, “A Comprehensive Analysis of BIM Technology’s Critical Role in Assessing Cost for Complex Dam Construction Projects,” *Mathematical Modelling of Engineering Problems*, vol. 10, no. 3, pp. 767–773, Jun. 2023, doi: 10.18280/mmep.100305.

[46] A. khalil and S. Naimi, “Automation of cost control process in construction project building information modelling (BIM) Periodicals of Engineering and natural sciences 10 (6) , 28-38

[47] M. Celikag and S. Naimi, “Building Construction in North Cyprus: Problems and Alternatives Solutions,” *Procedia Eng*, vol. 14, pp. 2269–2275, 2011, doi: 10.1016/j.proeng.2011.07.286.

[48] S. A. Assaf, M. Al-Khalil, and M. Al-Hazmi, “Causes of Delay in Large Building Construction Projects,” *Journal of Management in Engineering*, vol. 11, no. 2, pp. 45–50, Mar. 1995, doi: 10.1061/(ASCE)0742-597X(1995)11:2(45).

[49] N. Abeysinghe and R. Jayathilaka, “Factors influencing the timely completion of construction projects in Sri Lanka,” *PLoS One*, vol. 17, no. 12, Dec. 2022, doi: 10.1371/JOURNAL.PONE.0278318.

[50] A. H. Ghazy, M. R. Emara, A. M. Abdellah, and M. I. E. Attia, “Self-healing concrete techniques and performance, A review,” *Research on Engineering Structures and Materials*, 2023, doi: 10.17515/resm2023.51ma0615rv.

[51] A. H. Al-Momani, “Construction delay: a quantitative analysis,” *International Journal of Project Management*, vol. 18, no. 1, pp. 51–59, Feb. 2000, doi: 10.1016/S0263-7863(98)00060-X.

[52] M. I. Al-Khalil and M. A. Al-Ghafly, “Important causes of delay in public utility projects in Saudi Arabia,” *Construction Management and Economics*, vol. 17, no. 5, pp. 647–655, Sep. 1999, doi: 10.1080/014461999371259.

[53] A. Albogamy, N. Dawood, and D. Scott, “A Risk Management Approach to Address Construction Delays from the Client Aspect,” in *Computing in Civil and Building Engineering (2014)*, Reston, VA: American Society of Civil Engineers, Jun. 2014, pp. 1497–1505. doi: 10.1061/9780784413616.186.

[54] “Dodge, John Vilas, (25 Sept. 1909–23 April 1991), Senior Editorial Consultant, Encyclopædia Britannica, since 1972; Chairman, Board of Editors, Encyclopædia Britannica Publishers, since 1977,” in *Who Was Who*, Oxford University Press, 2007. doi: 10.1093/ww/9780199540884.013.U172122.

[55] C. Schenk, “2. The Multi-Level Balancing Act of Migration Management,” *Why Control Immigration?*, pp. 41–72, Aug. 2018, doi: 10.3138/9781487516352-006/HTML.

[56] R. Abdulwahhab, S. Naimi, and R. Abdullah, “Managing Cost and Schedule Evaluation of a Construction Project via BIM Technology and Experts’ Points of View,” *Mathematical Modelling of Engineering Problems*, vol. 9, no. 6, pp. 1515–1522, Dec. 2022, doi: 10.18280/mmep.090611.

[57] E. Karakan, “Comparative Analysis of Atterberg Limits, Liquidity Index, Flow Index and Undrained Shear Strength Behavior in Binary Clay Mixtures,” Aug. 2022, doi: 10.20944/preprints202208.0018.v1.

[58] A. Mikaeili and S. Naimi, “Preparing the Fragility Curve of Semi-Rigid Beam-to-Steel Column Connection,” *Indian J Sci Technol*, vol. 8, no. 28, Oct. 2015, doi: 10.17485/ijst/2015/v8i28/81886.

[59] M. Rahimi and S. Naimi, “comparsion of skyscraper bulding design: isolated foundations vs. non-isolated foundations,” *aurum Journal of Engineering Systems and Architecture*, vol. 7, no. 1, pp. 85–98, Jun. 2023, doi: 10.53600/ajesa.1321190.

[60] A. P. K. Locatelli and W. A. P. dos Santos, “Lean construction - Philosophy, principles, and implementation strategies,” in *III SEVEN INTERNATIONAL MULTIDISCIPLINARY CONGRESS*, in IIISIMC. Seven Congress, Aug. 2023. doi: 10.56238/seveniIMPIulti2023-034.

[61] M. S. Al-Saedi, S. Naimi, and Z. T. Al-Sharify, “A comprehensive review on the environmental impact of the climate change on water flow rate and water quality in Tigris River,” in *PROCEEDINGS OF THE TIM20-21 PHYSICS CONFERENCE*, AIP Publishing, 2023. doi: 10.1063/5.0150152.

[62] H. Almusaiabi and S. Naimi, “Total Quality Management’s Critical Role in Resolving Delay Issue of Construction Projects Submission,” *Mathematical Modelling of Engineering Problems*, vol. 10, no. 4, pp. 1419–1426, Aug. 2023, doi: 10.18280/mmep.100437.

[63] C. Zhaona, “Analysis on Construction Technology and Quality Control Measures of Building Steel Structure,” in *2021 2nd International Conference on Urban Engineering and Management Science (ICUEMS)*, IEEE, Jan. 2021. doi: 10.1109/icuems52408.2021.00073.

[64] S. Mohammed and S. Naimi, “Investigation of concrete properties using recycled waste concrete aggregate,” *Periodicals of Engineering and Natural Sciences (PEN)*, vol. 11, no. 1, p. 15, Feb. 2023, doi: 10.21533/pen.v11i1.3368.

[65] H. Albasri and S. Naimi, “Development of a hybrid artificial neural network method for evaluation of the sustainable construction projects,” *Acta logistica*, vol. 10, no. 3, pp. 345–352, Sep. 2023, doi: 10.22306/al.v10i3.378.

[66] A. N. Jabbar and S. Naimi, “Developing Adaptive Multi Dimension Road Construction Management Using EDAS Technique,” *International Journal of Sustainable Construction Engineering and Technology*, vol. 14, no. 4, Oct. 2023, doi: 10.30880/ijscet.2023.14.04.013.

[67] A. I. Al-Hadithi, N. N. Hilal, M. Al-Gburi, and A. H. Midher, “Structural behavior of reinforced lightweight self-compacting concrete beams using expanded polystyrene as coarse aggregate and containing polyethylene terephthalate fibers,” *Structural Concrete*, vol. 24, no. 5, pp. 5808–5826, Jun. 2023, doi: 10.1002/suco.202200381.

[68] B. M. Rethinavelsamy and N. Chidambarathanu, “Investigation on precast concrete paver block with waste tyre crumb rubber,” *Road Materials and Pavement Design*, vol. 17, no. 3, pp. 719–736, Dec. 2015, doi: 10.1080/14680629.2015.1119056.

[69] M. A. Akhund, A. Raza Khoso, J. Shahzaib Khan, H. Usama Imad, and K. Muhammad Memon, “Prompting cost overrun factors during PCP in construction projects,” *Indian J Sci Technol*, vol. 12, no. 4, pp. 1–7, Jan. 2019, doi: 10.17485/ijst/2019/v12i4/140936.

[70] G. Baldwin, *Final Report for FY15 Spent Fuel Project Task 12: Data Authentication*. 2016. doi: 10.2172/1600616.

[71] F. Dincer and M. E. Meral, “Critical Factors that Affecting Efficiency of Solar Cells,” *Smart Grid and Renewable Energy*, vol. 01, no. 01, pp. 47–50, 2010, doi: 10.4236/sgre.2010.11007.

[72] K. Sundareswaran, P. Sankar, P. S. R. Nayak, S. P. Simon, and S. Palani, “Enhanced Energy Output From a PV System Under Partial Shaded Conditions Through Artificial Bee Colony,” *IEEE Trans Sustain Energy*, vol. 6, no. 1, pp. 198–209, Jan. 2015, doi: 10.1109/tste.2014.2363521.

[73] G. Sweis, R. Sweis, A. Abu Hammad, and A. Shboul, “Delays in construction projects: The case of Jordan,” *International Journal of Project Management*, vol. 26, no. 6, pp. 665–674, Aug. 2008, doi: 10.1016/j.ijproman.2007.09.009.

[74] A. Shebob, N. Dawood, R. K. Shah, and Q. Xu, “Comparative study of delay factors in Libyan and the UK construction industry,” *Engineering, Construction and Architectural Management*, vol. 19, no. 6, pp. 688–712, Nov. 2012, doi: 10.1108/09699981211277577.

[75] A. M. Bassam, K. Sopian, A. Ibrahim, A. B. Al-Aasam, and M. Dayer, "Experimental analysis of photovoltaic thermal collector (PVT) with nano PCM and micro-fins tube counterclockwise twisted tape nanofluid," *Case Studies in Thermal Engineering*, vol. 45, p. 102883, May 2023, doi: 10.1016/j.csite.2023.102883.

[76] B. Sutanto and Y. S. Indartono, "Numerical approach of Al2O3-water nanofluid in photovoltaic cooling system using mixture multiphase model," *IOP Conf Ser Earth Environ Sci*, vol. 168, p. 12003, Jun. 2018, doi: 10.1088/1755-1315/168/1/012003.

[77] H. M. Mohamad, M. I. Mohamad, I. Saad, N. Bolong, J. Mustazama, and S. N. Mohd Razali, "A Case Study of S-Curve Analysis: Causes, Effects, Tracing and Monitoring Project Extension of Time," *Civil Engineering Journal*, vol. 7, no. 4, pp. 649–661, Apr. 2021, doi: 10.28991/cej-2021-03091679.

[78] L. Angrisani, G. Miele, R. Schiano Lo Moriello, and M. Vadursi, "A Kalman filtering based method for available bandwidth measurement," in *2015 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings*, IEEE, May 2015. doi: 10.1109/i2mtc.2015.7151446.

[79] G. M. Koot, "David Felix. Keynes: A Critical Life. (Contributions in Economics and Economic History.) Westport, Conn.: Greenwood Publishing Group, Inc. 1999 Pp. xvii, 322. 69.50. ISBN 0-313-28827-5.," *Albion*, vol. 32, no. 3, pp. 536–537, 2000, doi: 10.1017/s0095139000065443.

[80] W. Alaghbari, Mohd. Razali A. Kadir, A. Salim, and Ernawati, "The significant factors causing delay of building construction projects in Malaysia," *Engineering, Construction and Architectural Management*, vol. 14, no. 2, pp. 192–206, Mar. 2007, doi: 10.1108/09699980710731308.

[81] Wardah, "Identifikasi Faktor-Faktor Penyebab Keterlambatan pada Proyek Konstruksi Bendungan Paselloreng," *Jurnal Teknik Sipil MACCA*, vol. 5, no. 1, pp. 19–24, Feb. 2020, doi: 10.33096/jtsm.v5i1.10.

[82] B. Y. Renault, J. N. Agumba, and N. Ansary, "Investigating Risk Management Practices in Construction Projects in the Gauteng Province in South Africa: A

Contractors' Perspective," in *ICCREM 2016*, American Society of Civil Engineers, Aug. 2017. doi: 10.1061/9780784480274.161.

[83] J. Lim, "The balancing act of corporate political activity under institutional pressure," *Strateg Organ*, vol. 21, no. 4, pp. 856–873, Jul. 2022, doi: 10.1177/14761270221107694.

APPENDIX A

QUESTIONER

Factors contributing to the material shortage.

	Significantly Less Important	Less Important	Important	More Important	Significantly More Important
Technical	1	2	3	4	5

Procedures are established by rating using the Likert scale, where a score of 1 indicates the least significance and a score of 5 indicates the greatest relevance.

1…. Significantly Less
2…. Less Important
3…. Important
4…. More Important
5…. Significantly More Important

1. Survey Start

A- Assess the relative weight (importance) of the 20 issues generating delays in building projects.

Factors Causing Delay	1	2	3	4	5
Contract duration that is too long.					
The project's scope is not well defined.					
poor administration of contracts.					
inadequate project planning in the beginning.					
improperly early project schedule.					
Owner's late approval of design documentation.					
Work is put on hold.					
Owner's delay in making progress payments.					
Owner and other parties' poor communication.					

poorly managed site.					
Staff from the contractor assigned to the project was poorly qualified.					
Lack of resources.					
Equipment delivery is delayed.					
Delay in acquiring municipal permits.					
result of the weather.					
project traffic management.					
Uncertainty in politics.					
instability in the economy.					
modifications to laws and regulations.					

B- Analyze the key issues that cause material scarcity.

2. Technical Causes

Technical Causes	1	2	3	4	5
Lack of a reliable and practical test for building materials at the customs station.					
Absence of precise code requirements for building materials at a particular location.					
The seasoned employees' lack of understanding of the provisions of the customs legislation.					

3. Experience Causes

Experience Causes	1	2	3	4	5
Lack of oversight regarding the market's low-quality, inexpensive materials.					
Inadequate industrial management for the material manufacturer.					
The existing material factories do not have experienced owners or managers.					
Lack of a knowledgeable advisor and estimation to calculate the project's material requirements.					
Inability to manage construction materials on the job site.					

Lack of expertise on the market's material availability among consultants.						

4. Governmental Laws Causes

Governmental Laws Causes	1	2	3	4	5
Government regulations on the sale of construction materials are lacking.					
Government regulations governing the specifications of imported building materials are lacking.					
Every government location has a different set of specifications for building materials.					
Corruption that keeps imports from being profitable for producers.					
Lack of government assistance for managing private manufacturing facilities.					
There are no government programs to build and expand new factories.					
Financial issues and an unstable economy.					
Issues with safety, particularly during material transfers.					

5. Management Causes

Management Causes	1	2	3	4	5
Absence of sources for building supplies.					
Code requirements are not being updated to reflect the market.					
The project lacks a material management system.					
Lack of update of material requirements and availability as the project progresses.					
Lack of a good plan for material storage.					
The project's lack of adequate material storage.					